NEW TRENDS AND PROMISING DIRECTIONS IN MODERN EDUCATION "Al in Education"

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Editors Mohamed IBRAHIM Mevlüt AYDOĞM**UŞ** Yalçın TÜKEL ſ



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Mohamed Ibrahim Mevlüt AYDOĞMUŞ Yalçın TÜKEL

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Bu kitabın bütün yayın hakları Palet Yayınlarına aittir. Yayınevinin yazılı izni alınmadan, kaynağın açıkça belirtildiği tanıtmalar ve akademik çalışmalar haricinde, kısmen veya tamamen kitaptan alıntı yapılamaz. Eser, matbu yahut dijital ortamda kopyalanamaz, çoğaltılamaz ve yayımlanamaz.

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PREFACE

Artificial intelligence (AI) is revolutionizing various industries, including education. As AI capabilities advance, educational settings are increasingly adopting these technologies to enhance teaching and learning experiences. This comprehensive book, authored by experts from diverse disciplines, explores the multifaceted impacts of AI on education, examining AI-powered technologies from intelligent tutoring systems to personalized learning platforms.

The initial chapters delve into how AI-powered technologies, including chatbots and intelligent tutoring systems, are transforming traditional pedagogical approaches. They emphasize the importance of developing AI tools aligned with sound instructional design principles and ethical frameworks. Moving beyond theoretical discussions, the book presents real-world case studies showcasing AI integration in educational contexts ranging from K-12 to higher education. These case studies analyze both successful implementations and limitations, providing valuable insights into how educators are leveraging AI for personalized learning, improved assessment, and optimized student support.

The latter sections of the book focus on crucial considerations for policymakers, educators, and administrators, providing guidelines for the ethical and equitable deployment of AI in schools. They acknowledge the challenges posed by technological barriers, teacher readiness, and student access, highlighting the need for thoughtful governance. Additionally, the book explores the impact of the virtual world on education, offering an overview of key virtual technologies such as VR, AR, MR, XR, and BCIs. Examples are provided to illustrate how these technologies are creating more immersive and engaging learning experiences across various subjects.

Notably, the book balances its exploration of opportunities with a spotlight on challenges. Several chapters underscore the importance of equitable access, data privacy, algorithmic transparency, and ethical AI practices to engender trust and acceptance among students and educators. The closing chapters explore emerging ideas like the metaverse and transhumanism through an educational lens, outlining ambitious new directions for this rapidly evolving field.

Written in an authoritative yet accessible style, the book will serve as an invaluable resource for educators, researchers, policymakers, and technology developers interested in gaining an in-depth understanding of the AI revolution sweeping education. It captures the zeitgeist of this technological inflection point where education stands poised to be enhanced, accelerated, and expanded in exciting new ways by the power of artificial intelligence. This pioneering collection of insights paves the path forward by asking pertinent questions, spurring thoughtful debate, and envisioning a future where AI and humans collaborate synergistically to push the frontiers of learning.

In conclusion, this multifaceted exploration serves as an invaluable resource for those interested in understanding the AI revolution in education. Rather than advocating for a blind embrace of technology, the book champions deliberate and ethical innovation that enhances human-driven education. It encourages readers to think critically about the integration of AI into the classroom and provides both cautionary tales and inspirational case studies to guide institutions on this complex journey. The concluding chapter emphasizes several key themes: AI should augment, not replace, human teachers; transparency is crucial; broad access to AI benefits must be ensured; and AI literacy should be integrated across all levels of education. The book advocates upholding the values of humanism, ethics, and equity, recognizing AI's potential to make education more personalized and engaging while cautioning against eroding the diverse, creative, and compassionate dimensions of learning that define our humanity. The gathered perspectives aim to promote an ethical, empowering vision of AI innovation in education that ensures quality education is accessible to all, empowering generations to reach their full potential.

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DEVELOPMENT OF A VOICE RECOGNITION AND VOICE ASSISTANT CHATBOT

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Introduction

Manipulating robots in enhancing the lifestyle of mankind is ubiquitous nowadays. With the world pivoting on the cusp of the fourth industrial revolution (IR 4.0), the presence of robots has become indispensable. Wherever we are and whatever we are doing, one may easily encounter one of these machines in some ways or another. The variety of robots is quite diverse, and it could range widely from simple consumer products such as the autonomous vacuum cleaners and dishwashers to unmanned aerial vehicles (UAVs) to those bulky and sophisticated contraptions used in factories (Yeap et al., 2020).

The Institute of Electrical and Electronics Engineers (IEEE) provides the following definition for robots (IEEE, 2019):

"A robot is an autonomous machine capable of sensing its environment, carrying out computations to make decisions, and performing actions in the real world."

This definition implies that any machines which could interact with their environments can be classified as a robot. A robot is usually built with the intention of (Ho, 2004)

- i. mimicking a human's behaviour,
- ii. curtailing a human's burden, or
- iii. completing tasks which may seem indomitable for humans themselves to undertake

A humanoid robot which possesses the skill to talk is colloquially known as a chatbot. According to Bandopadhyay et al. (2023), a chatbot is a humanoid robot which is capable of emulating human communication through voice commands, text dialogues, or both, using artificial intelligence (AI). in short, it is an AI-based conversational machine which provides automated customer

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service through text- or voice-based interactions (Bandopadhyay et al., 2023). The ability of a chatbot to communicate with its users can be materialized by installing voice recognition and voice assistant algorithms into the microcontroller.

The first voice recognition systems were developed in the 1950s, but they were primitive and could only recognize a limited set of spoken words. Over the years, however, multitude sophisticated and matured algorithms have been developed in leaps and bounds. Today, voice recognition systems are used to control smart home devices, such as lights, thermostats, and security systems, without the need to touch switches or keypads. This can be especially beneficial for individuals who are self-isolating or quarantining, as it allows them to control their home environment without putting themselves or others at risk of infection.

In 1962, the first voice assistant was introduced by IBM in the World's Fair in Seattle (Patel and Verma, 2022). Known as the IBM Shoebox, this device was only capable of recognizing numbers from zero to nine and some six simple commands (Patel and Verma, 2022). Clearly, early voice assistants were rather limited in their capabilities. However, with the emergence of smartphones and the increasing availability of high-quality microphones, voice assistants have become more powerful and user-friendly. Today, voice assistants like Siri, Alexa, and Google Assistant are widely used by millions of people around the world to perform a variety of tasks, from setting reminders and making phone calls to controlling smart home devices and providing information about the weather, news, and more. Voice assistants are powered by a combination of natural language processing, machine learning, and speech recognition technologies. They use machine learning algorithms to analyse and interpret the meaning of spoken commands, and then execute actions based on those commands. These systems are continually learning and improving, allowing them to understand and respond to increasingly complex requests from users.

Overall speaking, voice recognition systems and voice assistants represent an exciting frontier in artificial intelligence and have the potential to revolutionize the way we interact with technology. As the technology continues to evolve, we can expect to see even more sophisticated voice-powered applications that can understand and respond to human speech in increasingly natural and intuitive ways.

The aim of this chapter is to describe the development process of a chatbot, equipped with voice recognition and voice assistant systems using Google Cloud Speech-to-Text approach. The readers are guided in a progressive and systematic way so that they could master the skill of creating a highly accurate, customizable, and user-friendly voice-powered application that can understand and respond to commands.

In general, the construction of the chatbot can be divided into two main parts. The first part involves setting up the hardware of the chatbot, whereas the second part involves developing the scripts for voice recognition and voice assistant.

Chatbots in Education

In today's rapidly evolving educational landscape, there is an increasing demand for personalized and efficient learning experiences. Traditional one-sizefits-all approaches to education often struggle to meet the diverse needs of individual learners. Students come from varied backgrounds, possess different learning paces, and exhibit unique strengths and weaknesses. Additionally, with the rise of online and remote learning, the absence of face-to-face interactions can leave students feeling isolated and unsupported. This is where chatbots come into play. Chatbots, powered by artificial intelligence (AI) and natural language processing (NLP), offer a solution to address these challenges. They have the potential to revolutionize education by providing personalized support, continuous assessment, and tailored learning paths for students. Chatbots not only enhance the efficiency of education but also contribute to a more inclusive and engaging learning environment, ultimately empowering students to achieve their educational goals effectively.

Potential of Chatbots to Personalize Learning

In the realm of education, chatbots are poised to revolutionize the way students learn. Powered by artificial intelligence, these virtual assistants have the capability to tailor learning experiences to the unique needs of individual learners. By assessing progress, providing instant feedback, and guiding students along personalized learning paths, chatbots hold the promise of making education more engaging, effective, and student-centric.

Chatbots can assess students' performance on quizzes, assignments, and other learning activities in real-time. They can monitor correct and incorrect answers, time spent on tasks, and completion rates. By collecting and analyzing this data, chatbots can identify patterns in students' strengths and weaknesses. For example, they may notice that a student consistently struggles with algebra but excels in geometry. Chatbots can generate individual progress reports for each student, highlighting areas where they need improvement. These insights are valuable for both students and educators. When a chatbot detects that a student is consistently struggling with a particular concept, it can alert teachers or instructors. Early intervention can prevent students from falling behind and provide additional support where needed.

Chatbots can provide immediate feedback on assignments, homework, and assessments. This feedback can include explanations of correct and incorrect answers, helping students understand their mistakes. Based on a student's performance and learning style, chatbots can suggest specific resources, such as articles, videos, or additional practice problems, to address areas where improvement is needed. Chatbots can create personalized study plans that outline what a student should focus on. These plans can adapt based on the student's progress and can suggest study schedules and milestones. Students can ask chatbots questions about course materials, and the chatbot can provide detailed explanations or direct them to relevant resources. This on-demand support is especially valuable for self-paced learners.

Chatbots can begin by assessing a student's current knowledge and skills through pre-tests or surveys. This assessment helps in identifying the student's baseline proficiency. Chatbots can then design a curriculum that adapts to the student's needs. For example, if a student already has a strong foundation in a particular subject, the chatbot can skip introductory material and focus on more advanced topics. As students make progress, chatbots can adjust the difficulty level of assignments and assessments. They can gradually increase the complexity of tasks to keep students challenged but not overwhelmed. in addition to traditional coursework, chatbots can suggest individual projects or assignments that align with a student's interests and career goals, fostering a sense of autonomy and relevance in learning. Chatbots can help students set specific learning goals and track their progress toward achieving those goals, providing a sense of purpose and direction in their studies.

All in all, chatbots play a pivotal role in personalizing learning by continuously tracking student progress, offering tailored feedback and guidance, and creating adaptive learning paths. By harnessing the power of AI and data analytics, chatbots enable educators to deliver more effective and customized educational experiences, ultimately improving student engagement and outcomes.

Ethical Implications

As chatbots become more prevalent in education, it's essential to address the ethical dimensions of their use. While these AI-driven tools hold great promise for personalized learning, they also raise important questions about data privacy, manipulation, and the need for clear ethical guidelines.

Chatbots often require access to personal information, such as names, email addresses, and learning data, to provide personalized experiences. The collection and storage of this data raise concerns about privacy and data security. Educational institutions and technology providers must implement robust security measures to protect this sensitive information from unauthorized access or breaches. Students and their guardians should be fully informed about what data is being collected, how it will be used, and who will have access to it. Obtaining informed consent ensures transparency and empowers individuals to make informed decisions about their data. Clear policies should define who owns the data collected by chatbots. It should ideally belong to the students, and they should have control over how their data is used, shared, and deleted. Educational institutions must establish guidelines for the retention of student data, ensuring that data is not stored indefinitely and is deleted when it is no longer necessary for educational purposes.

Chatbots must be programmed with ethical guidelines to prevent the dissemination of harmful or inappropriate content. They should not be used to manipulate or exploit students through deceptive messaging or persuasive tactics. Educational chatbots should not be designed to encourage addictive behavior or excessive screen time. There should be measures in place to promote responsible and balanced use of technology for learning. Care should be taken to avoid biases in chatbot responses or recommendations, as biased algorithms can reinforce stereotypes or discriminate against certain groups of students. Educational institutions should actively monitor the use of chatbots to ensure they are being used for their intended educational purposes and not for harmful activities.

Educational institutions should establish clear policies and guidelines for the use of chatbots in education. These policies should outline the purposes, limitations, and responsibilities associated with chatbot usage. The development and deployment of chatbots should be transparent, and stakeholders, including students, parents, and educators, should be involved in the decision-making process. There should be mechanisms in place to hold educational institutions and technology providers accountable for the ethical use of chatbots. This may include regular audits, compliance checks, and reporting mechanisms. Policies should be periodically reviewed and updated to reflect changing technological and ethical standards. Educators and administrators should receive training on the ethical use of chatbots and digital technologies in education to ensure they are aware of best practices and potential pitfalls.

While chatbots offer significant potential to enhance education, it is apparent that their use raises important ethical considerations related to data privacy, student manipulation, and the need for clear policies and guidelines. By addressing these concerns thoughtfully and proactively, educational institutions can harness the benefits of chatbots while safeguarding the rights and wellbeing of students.

Setting Up Hardware

To build a simple and affordable chatbot, only a microcontroller, a microphone, and a speaker are required. The microcontroller is used to process voice detected by the microphone, so that the chatbot is capable of responding to the user's inquiries by transmitting voice articulations from the speaker.

Microcontroller

Owing to its advanced processing capabilities and ability to run full-fledged operating systems, Raspberry Pi 4 Model B is chosen for the development of voice recognition and voice assistant. Before the power is supplied to Raspberry Pi, peripherals like mouse and keyboard should be connected to it by plugging them into the USB hub for interactions. An HDMI cable is used to connect the Raspberry Pi to the monitor so that the desktop graphical user interface (GUI) can be accessed on the monitor screen.

To install the necessary software into it, the Raspberry Pi is connected to the Wi-Fi network for internet connection. in this case, Visual Studio and VNC Viewer are to be installed into the microprocessor. Visual Studio is a popular integrated development environment (IDE) that supports multiple programming languages, including Python. Figure 1 depicts the interface of Visual Studio opened in Raspberry Pi.

RealVNC Viewer is also installed into Raspberry Pi so that it can be remotely accessed. The software has to be installed in both the Raspberry Pi microprocessor and the computer or device the user wishes to remotely access it. Raspberry Pi can be connected from the remote computer by entering the Raspberry Pi's IP address into the VNC viewer program. The IP address of Raspberry Pi can be retrieved by entering the command *<hostname -I>* in the terminal, as can be seen in Figure 2.

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Figure 1. Interface of Visual Studio



Figure 2. Retrieving the IP Address of Raspberry Pi

Microphone and Speaker

The next peripherals to set up are a speaker and a microphone. The speaker is used to generate sound or audio while the microphone works as a transducer which converts sound into electrical signal. They are the most indispensable devices in the development of a voice recognition system as the Raspberry Pi processes a spoken command captured from the microphone, and then generate audio output through the speaker to provide feedback to the user.

A mini-USB microphone such as that depicted in Figure 3 is recommended for the construction of an efficient and affordable voice recognition and voice assistant systems. This is because the device is small, light, portable, and easy to be set up. The sound captured by it is also acceptable and one good thing about it is that it is cordless, providing a clean set up.

A speaker with a USB port and an audio jack port, such as that shown in Figure 4, is recommended here. The USB port supplies power to the speaker while the audio jack transmits sound signal from the Raspberry Pi to the speaker.

Overall Hardware Setup

Figure 5 depicts graphically how the microphone and speaker are incorporated with the Raspberry Pi. Once they are connected properly to the Raspberry Pi, it is important to check that if both of them are working well. This can be done by entering the command <*arecord --format*=*S16_LE --rate*=*16000 --file-type*=*wav out.wav*> in the terminal to record a short voice recording and saving it as a waveform audio file format or WAV file (for eg., out.wav). Then, by using the command <*aplay out.wave*> to play the recording, the functionalities of the microphone and speaker could be verified.

In the event no sound output is detected from the speaker, the command < arecord -l> can be used for troubleshooting. The command allows users to view all available recording devices in the terminal as can be seen in Figure 6. The card number and device number can be obtained from the information listed in the terminal. This information is required to modify the configuration file so that the Alsa driver could determine the appropriate device used for capturing sound. Once the speaker and the microphone are calibrated properly, the user can then proceed to the next step, which is to create the virtual environment.



Figure 3. A mini-USB microphone



Figure 4. The speaker used for voice recognition and voice assistant



Figure 5. A bird's view of how the speaker and microphone are connected to the Raspberry Pi



Figure 6. The command used to list all hardware devices in the terminal

Setting Up Software

Once the hardware is connected and validated, scripts are to be written in the Raspberry Pi, so as to enable the capability of voice recognition and voice assistant. Prior to programming the microcontroller, however, the virtual environment is to be set up first. This is then followed by the installation of the libraries and dependencies.

Creating Virtual Environment

Virtual environments are created in Python to provide a way to isolate Python environments and dependencies for different projects. The reasons why virtual environment is used are listed below

- i. Dependency management: Different Python projects may require different versions of packages and dependencies. Creating a virtual environment allows the user to install and manage specific versions of packages and dependencies for each project, without affecting the system-level Python environment.
- ii. Isolation: Virtual environments provide a way to isolate Python environments for different projects, so that changes made to one project's environment do not affect other projects.
- iii. Versioning: Virtual environments allow the user to maintain multiple versions of Python on the same system, which can be useful when working with legacy code or when testing compatibility with different Python versions.

An example of the commands used to create the virtual environment is shown in Figure 7. Upon inspection, it can be observed that the term "(venv)" appears in front of the command prompt when the virtual environment is activated successfully. The descriptions of the commands used in Figure 7 are explained in Table 1. Generally, the virtual environment will not be deactivated once it is activated because Visual Studio will restore the session when it is restarted. As can be seen in Figure 8, the virtual environment of this work is created inside a folder named [vrecog] and it is always activated automatically in Visual Studio.

Installing Prerequisite Libraries and Dependencies

Libraries are necessary to be installed so that the voice recognition system works because they contain pre-built functions and code that enable the system to perform specific tasks. in the case of the SpeechRecognition library, it provides the necessary tools for the system to capture audio from a microphone or audio file and converts it into text. Without this library, it would be difficult to accurately transcribe audio. Table 2 shows the important libraries and dependencies installed in the virtual environment for the development of a voice recognition system.

Creating Code For Speech Recognition and Text to Speech

Once the prerequisite libraries and dependencies are installed successfully, the python script can be started to develop. The first script to be developed is used to execute speech recognition and text to speech function.



Figure 7. Steps to create a virtual environment



Figure 8. An example of how the virtual environment is activated automatically

Table 1.	Descriptions	for the	commands	used in	Figure 7
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Command Line	Description
cd Code_Testing/	Change directory to a new folder
python3 -m venv venv	Create virtual environment in Python 3
source venv/bin/activate	Activate the virtual environment
deactivate	Deactivate the virtual environment

Table 2. Prerequisite Libraries

Libraries	Description
Adafruit-Blinka	A package that allows you to use CircuitPython-compatible hardware like TFT display on a Raspberry Pi using Python3.
DateTime	A library for working with dates and times in Python.

geographiclib	A library that provides geodesic calculations for geospatial applications.
nltk	A library that provides tools for natural language processing.
numpy	A library for working with arrays and matrices in Python.
Pillow	A library for working with images in Python.
PyAudio	A library for working with audio in Python.
pyjokes	A library that provides a collection of programmer jokes.
pyowm	A library for working with the OpenWeatherMap API.
pyspellchecker	A library that provides spellchecking for Python.
python-espeak	A library that provides text-to-speech support using the eSpeak engine.
pyttsx3	A library that provides cross-platform text-to-speech support.
pytz	A library that provides timezone support for Python
pyusb	A library that provides support for USB devices
regex	A library that provides regular expression support for Python.
RPi.GPIO	A library that provides access to the Raspberry Pi's GPIO pins.
simpleaudio	A library that provides a simple way to play and record audio in Python.
SpeechRecognition	A library for performing speech recognition, which allows you to tran- scribe spoken words into text.
spidev	A library for interacting with devices that use the Serial Peripheral Inter- face (SPI) bus.
wordnet	A library that provides a database of English words and their relation- ships to one another.

In order to perform speech recognition, Google Cloud Speech-to-Text API is used. Google Cloud Speech-to-Text API is a powerful and easy-to-use tool for converting spoken words into written text. It uses advanced machine learning algorithms to analyse and transcribe audio signals, making it a popular choice for building voice assistants, transcription tools, and other applications that require speech recognition.

- iv. First Stage Audio input: The voice is fed into a microphone and the audio signal is captured as a digital file. This file is then sent to Google Cloud Speech-to-Text API for processing.
- v. Second Stage Pre-processing: Before the audio can be transcribed, it is pre-processed to remove any background noise or distortion that could interfere with the accuracy of the transcription. Google Cloud Speech-to-Text

API uses advanced signal processing techniques to enhance the audio signal and prepare it for transcription.

- vi. Third Stage Speech recognition: Once the audio has been pre-processed, Google Cloud Speech-to-Text API uses deep learning neural networks to analyse the audio signal and convert it into written text. These neural networks are trained on vast amounts of data, allowing them to recognize patterns in speech and accurately transcribe spoken words into text.
- vii. Fourth Stage Output: Once the speech has been transcribed, the resulting text is returned to the user's application or device as a text string. The confidence level of the transcription can be retrieved as shown in Figure 9 where it recognizes the command as "goodbye" with a confidence level of 0.956. The program can then use the transcribed text to perform the requested tasks or provide the necessary information.

The Pyttsx3 library is utilized to convert the text sentence to speech. Here, Pyttsx3 is a Python library that allows users to easily integrate text-to-speech functionality into the programs. It is built on top of the Microsoft Speech API, which provides a wide range of voices and languages for text-to-speech conversion. Firstly, a text string is passed to the pyttsx3 library, which represents the text to be spoken by the text-to-speech engine. Then, the pyttsx3 library initializes a speech engine, which is responsible for converting the text string into spoken words. The user can specify which voice to use for the text-to-speech conversion using the command *<setProperty(voice', voices[2].id)* > since Pyttsx3 provides a range of voices that are available through the Microsoft Speech API. Once the text, voice, and other settings like rate of speaking and volume have been specified, Pyttsx3 uses the speech engine to generate the spoken output. This output is then played directly through the speakers. After that, the runAndWait() method is used so that the system waits until the speech generation is complete before proceeding to the subsequent program.

Creating Main Script

A main script is created to coordinate the activities of the voice recognition system. in other words, the main script is responsible to control all operations within the system, viz it should be able to analyse and interpret the audio input from a user's voice, and then use that information to perform a specific task or provide a response. The main script created in this case is named myai.py as can be seen in Figure 10. in order to perform skills and voice recognition as well as text to speech function, those developed python files which are relevant should be imported to the main script.

The python script used for speech recognition and speaking is imported so that it can be easily called once the related function is to be performed. For example, the < command = myAI.listen() > command in Figure 11 is used to call the listening feature to recognize the voice command. The other python scripts developed to perform different skills are also imported here so that each skill

could be performed accordingly once the corresponding command is detected. The main script is iterated using a while loop, so that it repetitively processes the receiving commands and execute the corresponding tasks or generate the appropriate responses. Take for example the command list illustrated in Figure 12. If a command specified in the command list is detected, the function of the command (i.e., the skill to be performed by the system) will be invoked accordingly. Once the command has completed its execution, the command will be updated as empty string. This is to avoid confusion for the next voice command recognition. Since the program in the while loop is still running, the system continuously awaits a new command. The program of the voice recognition system will only be terminated if it receives commands such as "goodbye" or "bye-bye" or "bye". The whole operations and processes can be summarized in the flow chart shown in Figure 13.

Creating Skills

Each individual skill is developed in an independent python script. This allows the script to be validated separately. The script will only be incorporated into the main programme once it is free of bugs. in this work, a total of six main skills have been developed which include joke telling, simple home automation, to-do list management, weather skill, dictionary skill and date time skill.

'alternative': [{'confidence': 0.95641035, 'transcript': 'goodbye
'final': True}	(craiseripe : good bye]],
	Figure 9. Confidence level of transcription
🗢 my	∕ai.py ≻
1	from ai import AI
2	from weather import Weather
3	from datetime import date, datetime
4	import simpleaudio as sa
5	import homeAutomation as HA
6	import dictionary
7	import pyjokes
8	import random
9	import outputdisplay as display
10	import time
11	import re
12	import os
Figure 10. T	he command used to import Python scripts and libraries

```
while True and command not in ["goodbye", "bye", "bye-bye", "see you", "quit", "exit"]:
    try:
        command = myAI.listen()
        command_get = True
    except:
        command = ""
        command_get = False
```

Figure 11. A while loop is used in the main code so that the system is ready to receive commands

```
elif command in weather_commands:
    weather()
    command = ""
elif command in time_commands:
    inform_time()
    command = ""
elif command in date_commands:
    inform_date()
    command = ""
elif command in lightOn_commands:
    light_on()
    command = ""
elif command in lightOff_commands:
    light_off()
    command = ""
```





Figure 13. The flow chart of the main script

Joke Telling

Some of the specified commands are actually stored line by line inside a text file so that they can be accessed and modified conveniently. The commands list to execute joke telling is shown in Figure 14. As can be seen from the figure, the text files of each command list are located in a folder called [command lists].

Once one of the commands in this list is detected, the joke telling skill would be executed. The jokes are actually retrieved from Pyjokes library which is a Python library that provides a collection of jokes that can be used in Python programs. When the library is imported and a joke is requested, Pyjokes generates a random joke from its collection and returns it as a string. It is to be noted that the joke in the Pyjokes library are mostly related to programming and a novice without programming background may not be able to appreciate the jokes. in order to overcome this predicament, the default jokes in the library are replaced with some other funny jokes retrieved from the internet which are suitable for the public, as shown in Figure 15.

If the joke command is detected, the function joke() will be called. The syntax in the joke() function is shown in Figure 16. in the function, <py-

jokes.get_joke() > is the command used to retrieve jokes from the library. Since the updated jokes are mostly riddles, the questions and answers are told separately once a joke is randomly picked.



Figure 14. Joke commands list



Figure 15. Examples of the updated jokes obtained from the internet

95	def	joke():
		<pre>message = pyjokes.get_joke()</pre>
97		sayMessage(message[0])
		time.sleep(1.5)
		<pre>sayMessage(message[1])</pre>

Figure 16. The syntax of the joke() function

		light or	n.txt - M	lousepad	× ^	×			light of	f.txt - N	lousepad	× ^	×
File	Edit	Search	View	Document	Help		File	Edit	Search	View	Document	Help	
swit swit turn turn ligh	ch o ch o on on on on on	n the n light light the lig	light t ght				swit swit turr turr ligh	ch o ch o off off t off	ff the ff lig light the l f	ligh ht ight	t		Î

Figure 17. Commands list for switching on and off the light



Figure 18. Python script for home automation

Simple Home Automation

The simple home automation is demonstrated using a LED where it can be turned on or off once the corresponding command like "turn on the light" is detected. Figure 17 shows all the possible voice command to turn on or turn off the LED. The LED is connected to the GPIO pin of the Raspberry Pi. GPIO stands for General Purpose Input/Output and refers to the set of pins on the Raspberry Pi that can be used for controlling and communicating with other devices and circuits. These pins allow users to send and receive digital signals to and from external devices, such as sensors, motors, LEDs, and more. The whole python script written to execute home automation is depicted in Figure 18 and. As can be observed from the figure, GPIO 14 is used to control the LED. in line 6, the LED is initialized to be turned off and once the turn on function is called, it will then turn on the LED by feeding a logic high to GPIO 14.

To-Do List Management

There are three operations that are related to the to-do list; viz, add to-do, remove to-do and list to-do. Add to-do is used to add a new item to the to-do list, remove to-do is used to remove an item from the to-do list, and list to-do will list out the items inside the to-do list. The command lists of each operation are shown in Figures 19 to 21.



Figure 19. "Add To-do" commands list

remove to-do.txt - Mousepad ~ ~ × File Edit Search View Document Help remove todo remove item mark done remove todos remove to-do remove to do's

Figure 20. "Remove To-do" commands list

	d	~	^	×				
File	Edit	Search	n View	/ Docum	ent	He	elp	
list list list list list list	tod to to ite my	os o do to's m todo '	list					

Figure 21. "List To-do" commands list

In order to store the to-do item inside a list, a text file is created. An example of the text file is given in Figure 22. in the case of this work, the text file is named todolist.txt, as shown in the figure.

If the system detects the "add to-do" command, it will respond by asking the user about the exact item which is added to the list. The to-do list text file will then be opened, and the new item will be stored in a new line in the to-do list. On the other hand, if the system detects the "remove to-do" command, it will inquire the user the item to be removed from the list, in order to remove a specific item in the list, the system will first open and read the context from the to-do list text file. It will then go through the to-do list line by line. The item in each line of the list that does not match with the user's requirement will be re-written into the file; while the file which matches will be excluded. Once the item is removed successfully, the user will be notified. in the event the item to be removed does not match every line in the to-do list, the system will prompt the user by informing him/her that the item is not found in the list. Lastly, if the system detects the "list to-do" command, it will open the todo list file and spell out all the items inside the sequentially. Now, if there is nothing inside the to-do list, the system will inform the user that the list is empty.

Weather Reporting

Weather reporting skill is invoked when one of the following commands in Figure 23 is detected. Once the system recognizes the commands, the system will retrieve the weather information which includes the temperature, humidity, pressure, sunrise and sunset time, etc. and articulate it out.

The weather information is retrieved using PyOWM which is a Python wrapper around the OpenWeatherMap API. With PyOWM, users can retrieve weather forecasts, current weather conditions, and historical weather data for a specific location.

There are two important information to be inserted into the script so that the skill works accordingly. The first one is the API key which can be obtained by creating an account on the OpenWeatherMap website as shown in Figure 24. The next one is the city and country name.



Figure 22. An example of the to-do List

weather.txt - Mou	isepad 🗸 🗸	
File Edit Search View I	Document	Help
weather forecast what is the weather l tell me the forecast tell me the weather what's the weather what's the weather li tell me about the wea	like ike ather	
Figure 23. Weather skill o	commands li	st
in your city Guide API Dashboard M	larketplace Pricing	Mans

Partners Bloc OpenWeather New Products API keys Payments Block logs My orders My profile Services Billing plans Ask a que You can generate as many API keys as needed for your subscription. We accumulate the total load from all of them. Create key Key Name Status Actions a4a09b1999d5a95de37c9d57c867f346 C Default Active API key name Generate 08d2bbd209abc5dd34bcced19cc01f44 • 🕑 🗙 Al weather skill Active 062c07ecd2681658fc416de4908a2cbc weather Active 🖸 🗹 🗙 Figure 24. OpenWeatherMap website

Figure 25. The Regular Expression approach is used to define the list of keywords

Dictionary Checking

The dictionary allows users to search for the definition of any words. Two main functions have been written in the python script to enable the system to work as a dictionary, viz, checkWord and getRecords (refer to the appendices).

The checkWord function takes a single argument word and checks if it exists in the WordNet dictionary using the wordnet.synsets function. If the word exists, it is returned as it is. If the word is not found in the dictionary, a message is returned stating that the word was not found.

The getRecords function is built upon the checkWord function. It first calls the checkWord function to make sure that the word exists in the dictionary. If the word exists, it uses the wordnet.synsets function to retrieve the synonyms of the word. It then loops through the retrieved synonyms to extract the definition, examples, and part of speech (noun, verb, adjective, etc.) of each synonym. These are stored in the message variable and returned as output. If the word is not found, the output of checkWord is returned as it is. Notwithstanding, only the definition of a word is programmed to be articulated out by the proposed voice assistant. Below are the commands of how the dictionary skill can be activated:

- (i) define x
- (ii) search for x
- (iii) what does x mean
- (iv) what is the meaning of x

where the variable x denotes the word that the user wishes to find out.

The Regular Expression approach is used to find if the commands given by the user contain a specific keyword that prompts the system to work as a dictionary. Some of these keywords are "define", "search", "what" and "mean". The Regular Expression, commonly known as RegEx, is a unique set of characters that uses a pattern to search for a specific string or set of strings. Its purpose is to identify whether a text is present or not by comparing it with a specific pattern. The primary function of RegEx is to conduct a search by taking a regular expression and a string as inputs. in Figure 25, it can be found that re.search is used to determine if those specific words like search, mean and define present in the command.

28 | "AI in Education"

time.txt - Mousepad 🛛 👻 🔺 🗙	date.txt - Mousepad 🛛 🗸 🔺 🗙
File Edit Search View Document Help	File Edit Search View Document Help
what's the time tell me the time what time is it what is the time what is the time now tell me what time is it	what's the date tell me the date what date is it what is the date what is the date today tell me what date is it what date is it today

Figure 26. Time and date commands lists

```
def inform_time():
   time = time.split(" ")[1]
   time = time.split(":")[0:2]
   hours = int(time[0])
   minutes = time[1]
   day = " "
   if hours < 12:
          hours = 12
       hours = str(hours)
       if hours != 12:
           hours -= 12
       hours = str(hours)
   minutes = time[1]
   time = hours + ":" + minutes + day
   message = "It is " + time + "."
   sayMessage(message)
```

Figure 27. Function of the time reporting skill



Figure 28. Function of the date reporting skill

Date and Time Reporting

The date and time reporting skill is executed to inform the current time and date using the datetime module. The corresponding commands list is shown in Figure 26.

Figures 27 and 28 show how the two functions are developed. in this case, the Python built-in datetime module is used to extract the information for the current date and time. The datetime.now() function returns the current date

and time as a datetime object and the strftime() function is used to format the date as a string in the desired format.

In the inform_time() function, the current time is obtained using datetime.now(), and then the string is split and manipulated to get the hours, minutes, and AM/PM. Finally, the message is constructed with the time and passed to the sayMessage() function for the text-to-speech output.

In the inform_date() function, datetime.now() is used again to get the current date, which is then formatted using strftime() to get the day, month, and year as a string. This string is then concatenated with the rest of the message and passed to the sayMessage() function for the text-to-speech output.

Test Run

Every time a skill or a python script is developed, it is important to test run it to validate its performance. Test runs are an essential part of the software development process, and they should be carried out regularly throughout the development cycle.

Test runs help to identify bugs, errors, or other issues in the software before it is released to the end-users. By testing the code thoroughly, problems can be detected at an early stage, and this helps to avoid serious issues propagating down the line.

Besides, test runs help to ensure that the program and skill are working as intended and that it meets the requirements and specifications set out at the beginning of the project. By testing the scripts in different scenarios and under different conditions, their functionalities can be verified to operate correctly and the scripts themselves are compatible with each other.

Moreover, Test runs help to improve the overall quality of the program by identifying areas that need improvement and suggesting ways to optimize the code. By testing the software thoroughly and analysing the results, changes and improvements can be applied to the code that will help to increase its reliability, efficiency, and usability.

Lastly, test runs help to ensure that the software provides a positive user's experience and meets the needs of the end-users. By testing the software from the user's perspective, developers can identify any issues that might affect the user's experience and make changes to improve it.

Overall speaking, test runs are essential for ensuring the quality, functionality, and reliability of software during the development process. They help to identify issues at an early stage, improve the code quality, and enhance the user's experience, all of which are crucial for the success of any software projects.

Setting Up Tft Output Display

The output display selected for the work here is the ILI9341 thin-filmtransistor (TFT) display (shown in Figure 29). Besides being affordable, the display is also a high-performance display that can be used to display a wide range of graphics and images. It has a 2.8-inch screen and a resolution of 240 \times 320 pixels, which is sufficient to display text and graphics clearly.

In the voice recognition system, the display can be used to display the input voice command that the system has recognized. This is particularly useful for users who might want to know what input command that has been detected by the system. By displaying the recognized command, the user can verify if the system has accurately recognized the command that he/she has verbally given to it. Similarly, the display can also be used to display the output voice response from the voice assistant. This can be particularly useful in situations where the user may have difficulty hearing the voice response, or where the environment is noisy and the voice response may be difficult to be heard. Thus, the use of a high-performance TFT display like the ILI9341 can enhance the user's experience of a voice recognition system since it provides a clear and easy-to-read interface for displaying the input and output information. There are 8 pins to be connected from the TFT display to the Raspberry Pi and the pin configurations between the two hardware are shown in Table 3.

When setting up the TFT display, it is found that the Display could not automatically detect if the text exceeded its screen size. This issue is demonstrated in Figures 30 to 33. It can be observed from the figures that if the text line is too long, the text beyond the width or height of the screen will not be displayed.

In order to ensure that the complete sentence is displayed properly, text wrap approach has been used as shown in Figure 34. Before all the messages are displayed, they are gathered and saved in a text file named output.txt as shown in Figure 35. The lines in this file will then be read and wrapped using text wrap so that the long line could be altered to multiple short lines.



Figure 29. ILI9341 TFT Display

Figure 30. A long sentence to be printed out

TFT Display Pin	Raspberry Pi Pin
Vin	3 V
GND	Ground
CLK	SLCK
CS	CE0
D/C	GPIO 25
RST	GPIO 24
MOSI	MOSI

Table 3. Pin Configuration of TFT D	isplay
-------------------------------------	--------



Figure 31. Only part of the sentence shown in Figure 3.30 is displayed



Figure 32. Short sentences at multiple lines are to be printed out

32 | "AI in Education"



Figure 33. Only some of the sentences in Figure 3.32 are displayed



Figure 34. Text wrap approach



Figure 35. The output.txt file



Figure 36. The wrapped_output.txt file

The textwrap module in Python provides a convenient way to format text by wrapping it to a specified width. to solve the issue in Figure 31, the textwrap.wrap() function is used to wrap a line of text to a width of 26 characters. The line variable contains the original text that needs to be wrapped, and the width parameter specifies the maximum number of characters that each line can contain. The break long words parameter is set to False to specify that the function should not break long words that exceed the specified width. If this parameter were set to True, the function would attempt to break long words, which could result in words being split in the middle. The result of the textwrap.wrap() function call is a list of strings, where each string represents a single line of text that has been wrapped to the specified width. The list of wrapped lines is then saved into a new file named wrapped_output.txt as shown in Figure 36, so that they can be displayed on the TFT display. Upon inspecting Figure 36, it is noticed that the "command" or "speaking" word is appended at the end of each line after wrapping. These two keywords are actually used to identify the nature of the message - the "command" keyword indicates that the line is a voice command input; while "speaking" indicates that the line is an output that is to be articulated out by the system.

Figure 37 shows how the TFT display and LED are connected properly to the GPIO pins on Raspberry Pi. It is to be noted that although there are 14 pins available on the TFT display, only the first 8 pins are required to be used for displaying the messages. The remaining pins which include the Master in Slave Out (MISO) provide outputs given by the input of the touch screen and are not used in this case since the TFT display is only used to output the messages. The LED is connected in series with a resistor and it is controlled by GPIO 14. By setting this pin to HIGH, the LED will be switched on.





Figure 37. The (a) practical connections of the Raspberry Pi, TFT display, and LED with the breadboard and the (b) schematic view of the circuit connections

Improving Commands and Responses

The commands and responses can be improved so that the conversation between users and the system can be more interactive. One method to do so, is to increase more possible input commands and output responses. This means that different commands can be recognized to execute the same skill. By doing so, the system or the chatbot can become more human-like, since it can understand more possible commands. Moreover, the quantity of possible output responses is also increased so that the system can provide more than one possible response. Since there are multiple possible output responses to be spoken, the response is selected randomly using the random.choice() command. The possible input voice commands and their corresponding output responses are shown in Table 4.

It can be seen from the table that there are multiple commands that can be spoken by the users to interact with the system. As mentioned in the preceding section, most specified commands are actually saved in a text file. Before they are saved as text files, however, the commands are actually saved in a temporary list. By doing so, the system saves the trouble of opening and reading the text file to retrieve all the commands list before it starts listening for commands.

The user is also allowed to customize his/her own input commands. The usual method to do so is to open the main python file and modify the code. This method is tedious because the user has to be equipped with some basic programming knowledge. to simplify the process of customizing the input commands, an additional feature has been added into the proposed voice recogni-

tion system. The feature allows users to customize the commands via voice interaction. As a way to achieve this, all the customizable commands are stored inside their own commands list text file. When the user requests to modify the command, the customizable commands will be displayed and the users can choose to either add a new command or remove a command from the chosen commands list. Then, the system will open the selected commands list file and modify the commands inside. The user can also choose to cancel the modified commands by saying "cancel" or "never mind". The syntax of cancelling the modified commands is shown in Figure 38.

Overall Flow Improvement

The overall flow of the voice recognition system can be improved to enhance the user's experience. The features introduced into the system are adding sound effect, adding appropriate delay, and improving user's interface.

Sound effect can be added to enhance the user's experience and make the voice recognition system feel more engaging and interactive. For example, sound effect can be added to indicate that the system is listening for the user's input. However, it is important to use the sound effects sparingly. Overuse of sound effects can be distracting and annoying to the user. Additionally, it is important to choose the appropriate sound effects that are not too loud or jarring and that they have to be consistent with the overall tone and style of the voice recognition system. Figure 39 shows how the sound effect is played. Notice that the sound effect is a wav file and it is located inside a folder called [sound effect].

Adding appropriate delay can also enhance the user's experience when telling riddles or jokes in the voice assistant system. This delay can be used to build anticipation and create suspense before delivering the punchline. A well-timed pause provides the user with sufficient time to comprehend the information and to appreciate the joke better. to implement delay in a voice assistant system, the time module in Python is used to add a delay between the setup and punchline of the joke or riddle. As can be seen in Figure 40, the time.sleep() function is used to introduce a delay of a few seconds before delivering the punchline. The exact length of the delay depends on the length of the setup and the specific joke or riddle being told and it can be adjusted to achieve optimal effect.

Lastly, the user's interface can be enhanced by classifying the output text with different colour based on the nature of the message. As can be observed in the example in Figure 41, the recognized voice command can be displayed in green colour and the generated output response in blue colour. By using different colours for different types of commands and responses, the user can quickly identify the type of information being displayed. It therefore builds a more
intuitive and user-friendly environment for the voice recognition system. Additionally, the system also becomes more visually appealing and engaging.

Table 4. Possible Input Commands and Output Responses

Possible Input Commands	Possible Output Responses / Tasks Executed	
"tell me a joke"		
"tell me another joke"	Execute Joke Telling	
"tell me something funny"		
"add item"	"Tell me what to add to the list."	
"add to-do"	Execute Add To-Do	
"mark done"		
"remove todo"	"Tell me which item to remove."	
"remove item"	Execute Remove To-Do	
"remove todos"		
"list todo"	"I I	
"list item"	Free are your to dos.	
"list todos"	Execute List 10-D0	
"weather"	"I Jone's the sussether "	
"tell me the forecast"	Here's the weather.	
"what's the weather like"	Execute weather Forecast	
"light on"	"Cot it! The light is gwitched on "	
"turn on the light"	Got It! The light is switched on.	
"switch on the light"	Execute Turning Light On	
"light off"	"Optial The light is social of "	
"turn off the light"	Got It! The light is switched on.	
"switch off the light"	Execute Turning Light On	
"what's the time"		
"tell me the time"	Execute Time Telling	
"what time is it"		
"what date is it"		
"tell me the date"	Execute Date Telling	
"what is the date today"		
"define"	"Searching for the word "	
"search for"	"Hore's what I found "	
"what does mean"	Every Dictionary Skill	
"what is the meaning of"	Execute Dictionary Skin	
"add command"		
"modify command"	"Choose the command that you want to modify."	
"change command"	Execute Command Modification	
"remove command"		
"hi"	"Good day to you "	
"hey"	"Hello there, how can I help?:)"	
"hello"	"Hi I hope you are doing well"	
"good day to you"	Th, Thope you are doing wen.	
"how are you"	"Never been better:)"	
"how you doing"	"I'm feeling great. Thanks for asking."	
"how is your day"	"I couldn't be better. What can I do for you?:)"	
	"Sorry, could you repeat it?"	
Unclear Command / Unspecified Command	"I'm not sure what you're trying to say."	
	"I'm confused. Can you be more specific?"	
"exit"	"Goodbye!"	
"bye-bye"	Terminate the Programme	
"goodbye"	0 -	





Figure 39. Playing sound effects

95	def	joke():
96		<pre>message = pyjokes.get_joke()</pre>
97		sayMessage(message[0])
		time.sleep(1.5)
		<pre>sayMessage(message[1])</pre>
00		

Figure 40. Inserting appropriate time delay before the voice assistant could respond



Figure 41. Texts are displayed in different colours

Wake Word Detection

Wake word detection is used in a voice recognition system to wake up the system, so that it is ready to accept a voice command. It is developed after all other codes are done because it is the first step in processing a voice command. in this case, the wake word can also be modified, and it is stored in a text file named wake word.txt.

Using a wake word detection system to activate the voice recognition and voice assistant systems reduces the amount of processing power consumed by the system. Without the wake word, the system would have to be constantly activated, so that it is always ready to receive voice commands. The system therefore ends up consuming a lot of computing resources. By using a wake word, the system can remain in a dormant state until the wake word is detected. Once the wake word is detected, the system can then begin processing the voice command. Thus, the wake word detection system is an essential component of a voice recognition system that helps to optimize the system's performance and minimize its resource requirements.

Automating The Program

The whole program is set to run automatically once the Raspberry Pi is booted. By automating the startup process, users can save the time and effort that would otherwise be required if the system is manually activated. This can be especially useful if we want to run the program without having to connect the Raspberry Pi to a monitor, keyboard, and mouse to run it manually.

Several commands could be used to automate the program, namely, rc.local, .bashrc, init.d tab, system and crontab. One may encounter some common errors when using these commands. When using the crontab method, for instance, the program may not be able to run during startup. The common error message which appears when using this method is shown in Figure 42. This error occurs because there is no input device detected. When the Raspberry Pi starts up, it goes through a series of initialization steps, including loading drivers and initializing hardware devices. It is possible that the initialization for some of this hardware are not yet complete when the script starts to run, ensuing issues in accessing the microphone. The method which modifies the bashrc file to automate the program is shown in Figure 43. It is to be noted that, the last two lines in the figure are the commands added to run the main script, i.e., myai.py. This method allows the main script to be run when a terminal is opened. Now, if the program is to be restarted after it is terminated, then, instead of restarting the Raspberry Pi, the user only requires to open the terminal again. When using this method, however, one may easily encounter the error in Figure 44. This error occurs when the dictionary skill is executed and the wordnet which is a lexical database for the English language cannot be found. This error can be solved by adding the "-u pi" command into the original command after "sudo" as shown in Figure 45. The additional command is used to ensure that the script is run under the pi user's account, which is the default user for a Raspberry Pi. After this step, the myai.py script is run in the virtual environment venv which is located in the /home/pi/vrecog/ directory. This script contains the code for the voice recognition system. Hence, the voice recognition and voice assistant systems should be able to operate accordingly once this script is executed.

```
Traceback (most recent call last):
File "/home/pi/vrecog/myai.py", line 17, in <module>
    myAI = AI()
File "/home/pi/vrecog/ai.py", line 32, in __init__
    self.m = sr.Microphone()
File "/home/pi/vrecog/venv/lib/python3.7/site-packages/speech_recognition/__init__.py", li
    device_info = audio.get_device_info_by_index(device_index) if device_index is not None e
File "/home/pi/vrecog/venv/lib/python3.7/site-packages/pyaudio/__init__.py", line 812, in
    device_index = pa.get_default_input_device()
OSError: No Default Input Device Available
```

Figure 42. Error message that may appear when using crontab

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Figure 43. Modifying the bashrc file to automate the program

error.log - Mousepad	
File Edit Search View Document Help	
<pre>Traceback (most recent call last): File "/home/pi/vrecog/myai.py", line 278, in <module> dict() File "/home/pi/vrecog/myai.py", line 146, in dict definition = dictionary.getRecords(word) File "/home/pi/vrecog/dictionary.py", line 50, in getRecords word = checkWord(word) File "/home/pi/vrecog/dictionary.py", line 25, in checkWord if bool(wordnet.synsets(word)): File "/home/pi/vrecog/venv/lib/python3.7/site-packages/nltk/corpus/util.py", line 121, ingetat selfload() File "/home/pi/vrecog/venv/lib/python3.7/site-packages/nltk/corpus/util.py", line 86, inload raise e</module></pre>	tr
File "/home/pi/vrecog/venv/lib/python3.7/site-packages/nltk/corpus/util.py", line 81, inload root = nltk.data.find(f"{self.subdir}/{selfname}") File "/home/pi/vrecog/venv/lib/python3.7/site-packages/nltk/data.py", line 583, in find raise LookupError(resource_not_found)	
LookupError:	
Resource [93mwordnet[0m not found. Please use the NLTK Downloader to obtain the resource:	
ໝ[[31m>>> import nltk >>> nltk.download('wordnet') ໝ[Om For more information see: https://www.nltk.org/data.html	
Attempted to load 🖽[93mcorpora/wordnet[0m	
<pre>Searched in:</pre>	
Figure 44. The wordnet could not be found	

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Figure 45. Adding the "-u pi" command into the bashrc file



Figure 46. The voice recognition and voice assistant systems are integrated into a robotic head



Figure 47. Back view of the chassis

Completing The Chatbot

After all the software part has been developed and tested, the voice recognition and voice assistant systems are then installed into a chassis -- a robotic head which was built to look like the head of Iron Man. The purpose of doing so is to provide human touch to the chatbot. The final look of the chatbot is shown in Figure 46.

The Raspberry Pi, microphone, and speaker were installed into the robotic head while the TFT display is located next to it, so that the output messages can be shown to the users. The power supply cable and the HDMI cable (optional) are actually connected to the Raspberry Pi from the back of the head as shown in Figure 47.

Python Scripts Developed For The Chatbot

Below are brief descriptions of the python scripts used in the chatbot:

- i. The ai.py script is used for voice recognition and text to speech.
- ii. The dictionary.py script is used for dictionary skill.
- iii. The homeAutomation.py script is used for home automation skill.
- iv. The myai.py is the main script of the voice recognition and voice assistant systems.
- v. The outputdisplay.py script is used for displaying messages on TFT display.
- vi. The weather.py script is used for weather forecast.
- vii. For the convenience of the readers, the scripts are listed in the Appendices.

Challenges in The Development of Chatbots

In order to ensure that the chatbots are accurate and unbiased in their responses, it is advisable to observe the following:

- i. The Need to Carefully Train Chatbots on Large and Diverse Datasets. Chatbots rely on the data they are trained on to understand language and provide responses. to ensure accuracy and avoid bias, it's crucial to train them on high-quality, diverse datasets that reflect a wide range of perspectives and contexts. Biases in training data can lead to biased responses. Efforts must be made to identify and mitigate biases in datasets, as biases can perpetuate stereotypes or discrimination when chatbots interact with users. Training data should encompass diverse demographics, cultures, and languages to ensure that chatbots are capable of understanding and responding to a wide array of users.
- ii. The Need to Develop Methods for Detecting and Correcting Bias in Chatbot Responses. Implementing algorithms that can identify potentially biased responses is crucial. These algorithms can analyze chatbot interactions in real-time and flag responses that may exhibit bias. When bias is detected, chatbots should have built-in mechanisms to mitigate it. This might involve rephrasing responses or offering alternative information that is more balanced and neutral. Clear ethical guidelines should be established during the development process to guide chatbot behavior and ensure that they prioritize fairness and inclusivity.
- iii. The Need to Monitor Chatbot Responses for Accuracy and Bias on an Ongoing Basis. After deployment, chatbots should be continuously assessed for the accuracy and fairness of their responses. This includes regular evaluations of their performance and effectiveness in providing unbiased information. Encouraging users to provide feedback on chatbot interactions can help in identifying issues with accuracy and bias. Users often provide valuable insights that can guide improvements. Based on ongoing monitoring and feedback, chatbots should be iteratively improved. Developers should be ready to make updates to the chatbot's training data and algorithms to address emerging issues. Users should be made aware that chatbots are AI-driven and may not always provide perfect responses. This transparency helps manage user expectations and builds trust.

Ensuring that chatbots are accurate and unbiased in their responses is a multifaceted challenge that requires careful training, proactive bias detection and mitigation, and ongoing monitoring and improvement. By addressing these challenges systematically, developers and organizations can harness the potential of chatbots in education and other domains while upholding ethical standards and promoting fairness and inclusivity in human-computer interactions.

Conclusion

In a nutshell, a chatbot equipped with voice recognition and voice assistant systems has been successfully built. The main devices involved in the devel-

opment of the chatbot include a Raspberry Pi 4 Model B, a speaker, a microphone, and a TFT display. The system leverages Google Cloud Speech-to-text API for voice recognition, which produces highly accurate transcriptions with low response time. The system is also robust and capable of performing certain specified skills, namely joke telling, to-do list management, weather forecast, simple home automation, time and date telling, and dictionary skill.

One of the notable features of the system is that it allows users to customize specified commands via voice interaction, making it highly adaptable to individual user's needs. The chatbot also displays spoken voice commands and generates output responses on the TFT display, thereby improving the user's experience.

Furthermore, the chatbot is designed to ensure that the user's data is secured, which is crucial when dealing with sensitive data. Lastly, the system's source code is simple, making it easy for developers to understand and modify if necessary. Overall speaking, the chatbot is a highly functional and user-friendly voice recognition and voice assistant systems that offers a wide range of features and customization options.

References

- Bandopadhyay, D., Ghosh, R., Chatterjee, R., Das, N., & Sadhukhan, B. (2023). Speech recognition and neural networks based talking health care bot (THCB): Medibot. in 7th IEEE International Conference on Computing Methodologies and Communication, pp. 399-404.
- Ho, Y. K. (2004). Design and implementation of a mobile robot. Bachelor of Engineering Thesis, Universiti Teknologi Petronas.
- IEEE. 2019. Robots. IEEE spectrum. Available at: robots.ieee.org/learn/ (accessed April 30, 2020).
- Patel, D. & Verma, T. (2022). Application of voice assistant using machine learning: A comprehensive review. Advances and Applications in Mathematical Sciences, 21(9), 5063 – 5073.
- Yeap, K. H., Koh, J. H., Loh, S. H. & Dakulagi, V. (2020). Development of a Humanoid Robot's Head with Facial Detection and Recognition Features Using Artificial Intelligence. in Safety, Security, and Reliability of Robotic Systems: Algorithms, Applications, and Technologies (pp. 21-50). CRC Press.
- Themelis, C., & Sime, J.-A. (2020). From Video-Conferencing to Holoportation and Haptics: How Emerging Technologies Can Enhance Presence in Online Education? in Emerging technologies and pedagogies in the curriculum (pp. 261-276). Springer.

Appendices

Appendix A. myai.py

Importing necessary libraries and modules from ai import Al from weather import Weather from datetime import datetime import simpleaudio as sa import homeAutomation as HA import dictionary import pyjokes import random import outputdisplay as display import time import re import os # Clear the contents of the output file open('/home/pi/vrecog/output.txt', 'w').close() # Initialize an instance of the AI class mvAI = AI()# Function to add a new command to the specified command list def add command(choice): message = "Tell me the new command you want to add to <" + choice + "> commands." sayMessage(message) adding error = False while adding error == False: trv: # Listen for user input new_command = myAl.listen() # If user says "cancel" or "never mind", exit the function if new_command == "cancel" or new_command == "never mind": message = "No problem. Nothing is added \ to <" + choice + "> commands." sayMessage(message) adding_error = True else: # Write the new command to the specified command list file path = "/home/pi/vrecog/command lists/" + choice+ ".txt" f = open(path, "a") f.write(new command + "\n") f.close() message = "Added \"" + new command + " \"to one of \ the <" + choice + "> commands." sayMessage(message) adding error = True except: sayMessage("Please say the new command again.") adding error = False # Function to remove a command from the specified command list

def remove_command(choice): # Get the path to the specified command list file path = "/home/pi/vrecog/command lists/" + choice + ".txt"

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Display the existing commands in the specified command list with open(path, 'r+') as show_file: message = "Here are the existing commands of <" + choice + ">." sayMessage(message) for item in show_file: message = item sayMessage(message)

Prompt the user for the command to be removed message = "Tell me the command you want to remove\ from <" + choice + "> commands." sayMessage(message) removing_error = False removed = False

while removing_error == False:
try:
Listen for user input
remove_command = myAl.listen()

If user says "cancel" or "never mind", exit the function if remove_command == "cancel" or remove_command == "never mind": message = "No problem. Nothing is removed \ from <" + choice + "> commands." sayMessage(message) else: # Read the lines in the specified command # list file and remove the selected command

with open(path, 'r') as myfile: lines = myfile.readlines() with open(path, 'w') as myfile: for line in lines: if(line.strip("\n")!= remove_command): myfile.write(line) else: removed = True message = "Removed \"" + remove_command \ + "\" from <" + choice + "> commands." sayMessage(message)

#Message generated if command title not found if removed == False: message = "Command with title " + remove_command \ + " not found." sayMessage(message) removing_error = True

except: sayMessage("Please say the command to be removed again.") removing_error = False

Function to store messages to be displayed into text file def saveMessage(message): with open('/home/pi/vrecog/output.txt', 'a') as file: file.write(message+"\n")

display.show_text()

Function to say messages and call saveMessage() function def sayMessage(output): print(output) saveMessage(output) myAl.say(output)

Definig a function to execute joke telling def joke(): message = pyjokes.get_joke() sayMessage(message[0])# Saying the setup of the joke time.sleep(1.5)# Waiting for 1.5 seconds before saying the punchline sayMessage(message[1])# Saying the punchline of the joke

Defining a function to execute weather forecast def weather(): myweather = Weather()# Creating an instance of the Weather class message = myweather.forecast# Getting the weather forecast sayMessage(message)

Defining a function to inform the current time def inform_time(): time = str(datetime.now())# Getting the current time #print(time)

```
time = time.split(" ")[1]
time = time.split(":")[0:2]
```

hours = int(time[0]) minutes = time[1] day = " "

```
# Checking if it's morning or afternoon/evening
if hours < 12:
if hours == 0:
hours = 12
hours = str(hours)
day = "AM"</pre>
```

```
else:
day = "PM"
if hours != 12:
hours -= 12
hours = str(hours)
```

```
minutes = time[1]
time = hours + ":" + minutes + day
message = "It is " + time + "."
sayMessage(message)
```

```
# Defining a function to inform the current date
def inform_date():
today = datetime.now()
```

```
message = "Today is " + today.strftime("%d") + " "\
+ today.strftime("%B") + " " + today.strftime("%Y") + "."
sayMessage(message)
```

Defining a function to search for a word in a dictionary def dict():

```
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```

```
# Split the user command into words and check if it matches a pattern to search for a word's meaning
if (command.split()[-1] == "what" and command.split()[-2] == "means") or \
(command.split()[-1] == "what" and command.split()[-2] == "mean") :
word = command.split()[0]
elif command.split()[-1] == "mean" or command.split()[-1] == "means":
word = command.split()[-2]
else:
word = command.split()[-1]
#print(word)
message1 = "Searching for the word: " + word
sayMessage(message1)
# Use the dictionary module to get the definition of the word
definition = dictionary.getRecords(word)
if re.search("not found", definition):
sayMessage(definition)
else:
message2 = "Here's what I found."
sayMessage(message2)
sayMessage(definition)
# Defining a function to add an item to the to-do list
def add todo2():
item = ""
message = "Tell me what to add to the list."
sayMessage(message)
try:
# Use the myAI module to listen for the user's response
item = myAl.listen()
# If the user cancels or changes their mind, inform them that nothing has been added
if item == "cancel" or item == "never mind":
message = "No problem. Nothing is added to the list."
sayMessage(message)
else:
# If the user provides an item, write it to the to-do list file and inform\
# the user that it has been added
f = open("/home/pi/vrecog/todolist.txt", "a")
f.write(item + "n")
f.close()
message = "Added " + item
sayMessage(message)
return True
except:
# If there is an error when recognizing phrases, \setminus
#inform the user and return False
print("Opps, there was an error")
return False
# Defining a function to remove an item from the to-do list
def remove todo2():
removed =False
```

message = "Tell me which item to remove."

sayMessage(message)

try: item = myAl.listen() if item == "cancel" or item == "never mind": message = "No problem. Nothing is removed from the list." sayMessage(message) else: # If the user provides an item, read the to-do list file and\ # remove the item if it exists with open("/home/pi/vrecog/todolist.txt", 'r') as myfile: lines = myfile.readlines() with open("/home/pi/vrecog/todolist.txt", 'w') as myfile:

for line in lines: if(line.strip("\n")!= item): myfile.write(line) else: removed = True message = "Removed " + item +"." sayMessage(message)

if removed == False: message = "Item with title " + item + " not found." sayMessage(message)

return True except: print("Opps, there was an error.") return False

Defining a function to list all items from the to-do list def list_todos2(): with open("/home/pi/vrecog/todolist.txt", 'r+') as myfile: if os.path.getsize('/home/pi/vrecog/todolist.txt') != 0: message = "Here are your to do's." sayMessage(message)

Iterate through each line in the file and read it for item in myfile: message = item sayMessage(message) else: message = "The list is empty!" sayMessage(message)

Defining a function to turn on LED def light_on(): HA.on() message = "Got it! The light is switched on." sayMessage(message)

Defining a function to turn off LED
def light_off():
HA.off()
message = "Got it! The light is switched off."
sayMessage(message)

Defining a function to play song def playSong():

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wave_obj1 = sa.WaveObject.from_wave_file("/home/pi/\
vrecog/music/Doraemon.wav")
message = "Got it! Playing your favourite song."
sayMessage(message)
play_obj1 = wave_obj1.play()
play_obj1.wait_done()

Defining a function to modify command def modify_command(command): input_error = False prompt_error = False

List of available commands to be modified command_list = ["joke", "add to do", "remove to do", "list to do", "add todo", \ "remove todo", "list todo", "add-todo", "remove to-do", "list to-do", "weather", "time", "time", "date", "light on", "light off", \ "wake word", "cancel", "never mind"]

If the command contains "modify" or "change" if re.search("modify", command) or re.search("change", command):

Prompt the user to specify if they want to add or remove a command sayMessage("Sure. Please tell me that if you want to add a command or remove a command.") while prompt_error == False: try: command = myAl.listen()

If the user cancels or says "never mind", exit the loop if command == "cancel" or command == "never mind": message = "No problem. Nothing is modified to the commands." sayMessage(message) prompt_error = True

If the user wants to add or remove a command, exit the loop elif re.search("add", command) or re.search("remove", command): sayMessage("Got it!") prompt_error = True

If the input is invalid, prompt the user to specify again
else:
sayMessage("Sorry, please specify if you want to add command or remove command.")
prompt_error = False
except:
sayMessage("Please specify if you want to add command or remove command.")
prompt_error = False

Message to display the available commands command_message = "Here are the commands that you can modify:\n<joke>, <add to do>, \ <remove to do>, <list to do>, <weather>, <time>, <date>, <light on>, <light off> and <wake word>."

If the user wants to add a command if re.search("add", command): prompt_error = False

Display the available commands sayMessage(command_message) sayMessage("Choose the command that you want to modify.") while prompt_error == False: trv: command choice = myAI.listen() prompt error = True except: sayMessage("Please choose the command you want to modify again.") prompt_error = False # Validate the user's input while command choice not in command list: if input_error == False: sayMessage("Sorry, you can only choose to modify the command from below:\n<joke>, \ <add to do>, <remove to do>, <list to do>, <weather>, <time>, <date>, \ light on>, <light off> and <wake word>.\nPlease choose the command you want to modify again.") else sayMessage("Please choose the command you want to modify again.") trv: command choice = myAI.listen() input error = False except: print("Opps, there was an error") input error=True # Modify the command based on the user's choice if command choice == "joke": add command("joke") elif command choice == "add to do" or command choice == "add to-do": add command("add to-do") elif command choice == "remove to do" or command choice == "remove to-do": add command("remove to-do") elif command choice == "list to do" or command choice == "list to-do": add command("add to-do") elif command choice == "weather": add command("weather") elif command choice == "time": add command("time") elif command choice == "date": add command("date") elif command_choice == "light on": add_command("light on") elif command choice == "light off": add command("light off") elif command_choice == "wake word": add_command("wake word") elif command choice == "cancel" or command choice == "never mind": message = "No problem. Nothing is modified to the commands." sayMessage(message) except: sayMessage("Please choose the command you want to modify again.") prompt_error = False while command choice not in command list: if input error == False: sayMessage("Sorry, you can only choose to modify the command from below:\n<joke>, \ <add to do>, <remove to do>, <list to do>, <weather>, <time>, <date>, \ light on>, <light off> and <wake word>.\nPlease choose the command you want to modify again.") else

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sayMessage("Please choose the command you want to modify again.") try: command choice = myAI.listen() input error = False except: print("Opps, there was an error") input error=True if command choice == "joke": remove command("joke") elif command choice == "add to do" or command choice == "add to-do" or command choice == "add todo": remove command("add to-do") elif command choice == "remove to do" or command choice == "remove to-do" or command choice == "remove todo": remove_command("remove to-do") elif command_choice == "list to do" or command_choice == "list to-do" or command_choice == "list todo": remove command("add to-do") elif command_choice == "weather": remove command("weather") elif command choice == "time": remove command("time") elif command choice == "date": remove_command("date") elif command_choice == "light on": remove command("light on") elif command choice == "light off": remove command("light off") elif command choice == "wake word": remove command("wake word") elif command choice == "cancel" or command choice == "never mind": message = "No problem. Nothing is modified to the commands." sayMessage(message) # Open and read specified commands from each text file

Store each command as an item in a list variable with open("/home/pi/vrecog/command lists/joke.txt", 'r') as jokefile: joke_commands = jokefile.read().splitlines()

with open("/home/pi/vrecog/command lists/add to-do.txt", 'r') as addTodo_file: addTodo_commands = addTodo_file.read().splitlines()

with open("/home/pi/vrecog/command lists/remove to-do.txt", 'r') as removeTodo_file: removeTodo_commands = removeTodo_file.read().splitlines()

with open("/home/pi/vrecog/command lists/list to-do.txt", 'r') as listTodo_file: listTodo_commands = listTodo_file.read().splitlines()

with open("/home/pi/vrecog/command lists/weather.txt", 'r') as weather_file: weather_commands = weather_file.read().splitlines()

```
with open("/home/pi/vrecog/command lists/time.txt", 'r') as time_file:
time_commands = time_file.read().splitlines()
```

```
with open("/home/pi/vrecog/command lists/date.txt", 'r') as date_file:
date_commands = date_file.read().splitlines()
```

```
with open("/home/pi/vrecog/command lists/light on.txt", 'r') as lightOn_file:
lightOn_commands = lightOn_file.read().splitlines()
```

with open("/home/pi/vrecog/command lists/light off.txt", 'r') as lightOff_file: lightOff_commands = lightOff_file.read().splitlines()

```
with open("/home/pi/vrecog/command lists/wake word.txt", 'r') as wakeWord_file: wakeWord_commands = wakeWord_file.read().splitlines()
```

```
# Initialize an empty string for storing the voice command command = ""
```

```
print("Hello!")
saveMessage("Hello!")
myAI.say("Hello!")
```

```
# Loop to keep the program running until the user says a command to exit
while True and command not in ["goodbye", "bye", "bye-bye", "see you", "quit", "exit"]:
try:
# Listen for a command from the user
command = myAl.listen()
command get = True
```

```
except:
# If there's an error, set the command to an empty string and set the flag to false
command = ""
command_get = False
```

```
# Set flags to track whether add and remove to-do have been completed flag1,flag2 = False,False
```

```
# If the command is in the specified command list, execute each atsk accordingly
if command in joke commands:
joke()
command = ""
elif command in addTodo commands:
while flag1 == False:
flag1 = add_todo2()
command = ""
elif command in listTodo_commands:
list todos2()
command = ""
elif command in removeTodo_commands:
while flag2 == False:
flag2 = remove todo2()
command = ""
elif command in weather_commands:
weather()
command = ""
elif command in time_commands:
inform time()
command = ""
elif command in date_commands:
inform date()
command = ""
elif command in lightOn commands:
light on()
command = ""
elif command in lightOff commands:
light off()
```

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```
command = ""
elif command in ["play music", "play song", "play a music", "play a song", \
"play the song", "play the music", "music", "song"]:
playSong()
command = ""
elif command in ["change command", "modify command", "change a command", \
"modify a command", "change the command", "modify the command", \
"add command", "remove command", "add a command", "remove a command", \
"add the command", "remove the command"]:
modify_command(command)
command = ""
# If the command is a search command, look up the term and reset the command
elif re.search("search for", command) or re.search("search", command) or re.search("what", command) or \
re.search("mean", command) or re.search("define", command) or re.search("what's", command):
dict()
command = ""
elif command in ["good morning", "good afternoon", "good evening", "good night", "goodnight"]:
now = datetime.now()
hr = now.hour
if hr >=5 and hr <12:
message = "Morning"
if hr >=12 and hr<18:
message = "Afternoon"
if hr>=18 and hr<21:
message = "Evening"
if hr >= 21 or (hr>=0 and hr <5):
message = "Night"
message = "Good " + message + "!"
sayMessage(message)
command = ""
elif command in ["hello", "hi", "hey", "hello there", "hey there", "good day to you", \
"good day", "hey jarvis"]:
greetings = ["Good day to you.","Hello there, how can I help?:)","Hi, I hope you are doing well."]
message = random.choice(greetings)
print(message)
saveMessage(message)
myAl.say(message)
command = ""
elif command in ["how are you", "how you doing", "how are you doing", "how is it going", "how is your day"]:
greetings2 = ["I'm feeling great. Thanks for asking.","I couldn't be better. What can I do for you?:)","Never been
better:)"]
message = random.choice(greetings2)
print(message)
saveMessage(message)
myAl.say(message)
command = ""
#If the command is unclear or unspecified
elif command_get == True and command not in ["goodbye", "bye", "bye-bye", "see you"]:
unclear response = ["Sorry, I don't understand.", "I'm not sure what you're trying to say.", \
"I'm confused. Can you be more specific?", "Sorry, could you repeat it?"]
message = random.choice(unclear_response)
print(message)
saveMessage(message)
myAl.say(message)
command = ""
```

#Say Goodbye and terminate the program print("Goodbye!") saveMessage("Goodbye!") myAl.say("Goodbye!")

#Uncomment below command if wants to rerun the program automatically once it is terminated #os.execv(sys.executable, [sys.executable] + sys.argv)

Appendix B. ai.py

Import necessary libraries and modules import time import pyttsx3 import simpleaudio as sa import outputdisplay as display import speech_recognition as sr

Define a function to save messages to be displayed to a text file def saveMessage(message): with open('/home/pi/vrecog/output.txt', 'a') as file: file.write(message+"\n")

Call the function from the outputdisplay library to display the message display.show_text()

Read the wake word commands from a text file with open("/home/pi/vrecog/command lists/wake word.txt", 'r') as wakeword_file: wakeword_commands = wakeword_file.read().splitlines()

Define a class for the AI assistant
class AI():
___name = ""
__skill = []

def __init__(self, name=None):
Initialize the text-to-speech engine
self.engine = pyttsx3.init()

Set the rate of speech for the engine rate = self.engine.getProperty('rate') self.engine.setProperty('rate', 175)

Initialize the speech recognition module self.r = sr.Recognizer() self.m = sr.Microphone()

if name is not None: self.___name = name

Adjust for ambient noise when starting up with self.m as source: self.r.adjust_for_ambient_noise(source)

Play a sound effect to indicate the AI assistant is active wave_obj1 = sa.WaveObject.from_wave_file("/home/pi/vrecog/sound effect/ES_Monitor Turn On - SFX Producer.wav") play_obj1 = wave_obj1.play() 56 | "AI in Education"

play_obj1.wait_done()

phrase = ""

Provide instructions to the user to activate the AI assistant saveMessage("To talk to me, say: \"Hey Assistant\".")

Continuously listen for the wake word until it is recognized while phrase not in wakeword_commands: with self.m as source: audio = self.r.listen(source) try: phrase = self.r.recognize_google(audio, show_all=False, language="en_UK") print(phrase) self.engine.runAndWait() except: print("Command not recognized.")

self.engine.runAndWait()

print("Listening...") saveMessage("Listening...")

Play a sound effect to indicate the AI assistant is ready to receive commands wave_obj1 = sa.WaveObject.from_wave_file("/home/pi/vrecog/sound effect/ES_MM Notification 11 - SFX Producer.wav") play_obj1 = wave_obj1.play() play_obj1.wait_done()

#time.sleep(1)

@property def name(self): return self.___name

@name.setter
def name(self, value):
sentence = "Hello, my name is" + self.___name
self.___name = value
self.engine.say(sentence)
self.engine.runAndWait()

Method to speak a given sentence def say(self, sentence): self.engine.say(sentence) self.engine.runAndWait()

Method to listen for a command and return the spoken phrase def listen(self):

#Captures audio from the microphone
with self.m as source:
audio = self.r.listen(source)
#print("Got it!")

try:

#This block of code uses the speech_recognition library to listen for and recognize # speech input using Google's Speech Recognition API. The recognized speech is then

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converted to lowercase, a sentence is created that indicates what the recognized command # was, and the sentence is written to a file using the saveMessage function. Finally, the # sentence is spoken out loud using the pyttsx3 library's runAndWait method. phrase = self.r.recognize_google(audio, show_all=False, language="en_UK") phrase = phrase.lower() sentence = "Command was: " + phrase saveMessage(sentence) #self.engine.say(sentence) self.engine.runAndWait() except: #Message generated if the audio is failed to be recognized print("Sorry, didn't catch that.") saveMessage("Sorry, didn't catch that.") self.engine.say("Sorry didn't catch that.") self.engine.runAndWait() #print("You said", phrase) return phrase

Appendix C. outputdisplay.py

Importing necessary libraries import digitalio import re import board import textwrap from PIL import Image, ImageDraw, ImageFont from adafruit_rgb_display import ili9341

Configuration for CS and DC pins (these are PiTFT defaults): cs_pin = digitalio.DigitalInOut(board.CEO) dc_pin = digitalio.DigitalInOut(board.D25) reset_pin = digitalio.DigitalInOut(board.D24)

```
# Config for display baudrate (default max is 24mhz):
BAUDRATE = 24000000
```

```
# Setup SPI bus using hardware SPI:
spi = board.SPI()
```

```
# Create the display
disp = ili9341.ILI9341(
spi,
rotation=90, # 2.2", 2.4", 2.8", 3.2" ILI9341
cs=cs_pin,
dc=dc_pin,
rst=reset_pin,
baudrate=BAUDRATE,
)
```

```
def show_text():
# Create a blank image for drawing.
if disp.rotation % 180 == 90:
height = disp.width # swap height/width to rotate to landscape!
width = disp.height
else:
width = disp.width
height = disp.height
image = Image.new("RGB", (width, height))
```

Create a drawing object. draw = ImageDraw.Draw(image)

Draw some text. font = ImageFont.truetype("/usr/share/fonts/truetype/dejavu/DejaVuSans.ttf", 20)

```
# Open the output.txt file and wrap the text to fit the screen.
# Then add color to each line based on the type of message.
# Write the wrapped text to the wrapped output.txt file.
with open('/home/pi/vrecog/output.txt', 'r') as infile, open('/home/pi/vrecog/wrapped_output.txt', 'w') as outfile:
for line in infile:
#Add a marking at the end of line for color classification later based on message nature
if re.search("Listening",line) or re.search("Say something",line) :
color = "message"
elif re.search("Command was",line):
color = " command"
elif re.search("To talk to me,", line):
color = " main"
olco.
color = " speaking"
wrapped lines = textwrap.wrap(line, width=28, break long words=False)
for wrapped_line in wrapped_lines:
outfile.write(wrapped_line + color + '\n')
# Open the wrapped output.txt file and read the lines.
# Calculate the number of lines in the file and set the starting y position for the text.
# Loop through the lines and draw them on the image with the appropriate color based on the type of message.
with open("/home/pi/vrecog/wrapped_output.txt", 'r') as myfile:
text lines = myfile.readlines()
num lines = len(text lines)
text y = 10
n = num lines - 10
line_height = font.getsize("Sample")[1]
# If there are more than 10 lines, display the last 10
if num_lines > 10:
while n!= num lines:
classification = text lines[n].split()[-1]
if classification == "message":
draw.text((10, text_y), " ".join(text_lines[n].split()[:-1]), font=font, fill=(255, 255, 255))
elif classification == "command":
draw.text((10, text_y), " ".join(text_lines[n].split()[:-1]), font=font, fill=(0, 255, 0))
else:
draw.text((10, text_y), " ".join(text_lines[n].split()[:-1]), font=font, fill=(0, 255, 255))
text_y += line_height
n+=1
#Else display the first 10 lines
else:
for line in text lines:
classification = line.split()[-1]
if classification == "message":
draw.text((10, text_y), " ".join(line.split()[:-1]), font=font, fill=(255, 255, 255))
```

elif classification == "command": draw.text((10, text_y), " ".join(line.split()[:-1]), font=font, fill=(0, 255, 0)) elif classification == "main": draw.text((10, text_y), " ".join(line.split()[:-1]), font=font, fill=(255, 0, 0)) else: draw.text((10, text_y), " ".join(line.split()[:-1]), font=font, fill=(0, 255, 255))

text_y += line_height

Display the image on the TFT display. disp.image(image)

Appendix D. homeautomation.py

Importing the RPi.GPIO library for accessing the GPIO pins of the Raspberry Pi import RPi.GPIO as GPIO

Setting the numbering mode of the GPIO pins to BCM GPIO.setmode(GPIO.BCM)

Setting up pin 14 as an output pin with an initial value of LOW GPIO.setup(14,GPIO.OUT,initial=GPIO.LOW)

Define two functions to turn on and off the LED connected to pin 14 def on():# Setting the value of pin 14 to HIGH GPIO.output(14,GPIO.HIGH)

def off(): # Setting the value of pin 14 to LOW GPIO.output(14,GPIO.LOW)

Appendix E. dictionary.py

Importing necessary libraries and modules import sys from nltk.corpus import wordnet from spellchecker import SpellChecker import re

Initialize an instance of the dictionary
dictionary = SpellChecker()

def checkWord(word): # """ # Check if word exist in dictionary

If not it will try to make suggestions.
"""
if bool(wordnet.synsets(word)):
return word

else: message = "The word \""+ word + "\" was not found in dictionary. " return message

```
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```

```
def getRecords(word):
#"""Search a word in dictionary and print its coincidences"""
word = checkWord(word)
if re.search("not found", word):
return word
else:
syn = wordnet.synsets(word)
dform = {
"n": "noun",
"v": "verb",
"a": "adjective",
"r": "adverb",
"s": "adjective satellite",
}
ctr1 = 1
ctr2 = 97
antonyms = list()
message = ""
for i in syn[:2]:
ctr2 = 97
definition, examples, form = i.definition(), i.examples(), i.pos()
message += "\nDefinition "+ str(ctr1)+ ": "+ str(definition.capitalize()) + ".\n"
ctr1 += 1
return message
Appendix F. weather.py
# Importing necessary libraries
from pyowm import OWM
from geopy import Nominatim, location
from datetime import datetime
import pytz
class Weather():
# The location of where you want the forecast for
# location = "Kampar, MY"
# API Key
api_key = "08d2bbd209abc5dd34bcced19cc01f44"
```

def __init __(self):
Creating a weather manager instance using the OWM API key
self.ow = OWM(self.api_key)
self.mgr = self.ow.weather_manager()

Creating a geolocator instance to get the latitude and longitude of the location locator = Nominatim(user_agent="myGeocoder")

Setting the location to Kampar, MY city = "Kampar" country = "MY" self.__location = city + ", " + country # Using geolocator to get the latitude and longitude of the location loc = locator.geocode(self.__location)

print(loc)

```
# Storing the latitude and longitude in the object instance
self.lat = loc.latitude
self.long = loc.longitude
#Determine message to be shown based on UV index
def uv index(self, uvi:float):
""" Returns a message depending on the UV Index provided """
message = ""
if uvi <= 2.0:
message = "The Ultraviolet level is low, no protection is required."
if uvi >= 3.0 and uvi <6.0:
message = "The Ultraviolet level is medium, skin protection is required."
if uvi >= 6.0 and uvi <8.0:
message = "The Ultraviolet level is high, skin protection is required."
if uvi >= 8.0 and uvi <11.0:
message = "The Ultraviolet level is very high, extra skin protection is required."
if uvi >= 11.0:
message = "The Ultraviolet level is extremely high, caution is advised and extra skin protection is required."
return message
@property
def weather(self):
#Retreive forecast information
forecast = self.mgr.weather at place("Kampar, MY")
return forecast
@property
def forecast(self):
""" Returns the forecast at this location """
forecast = self.mgr.weather_at_place("Kampar,MY")
#print(forecast.weather)
# Extract various weather parameters from the forecast
detail_status = forecast.weather.detailed_status
pressure = str(forecast.weather.pressure.get('press'))
humidity = str(forecast.weather.humidity)
sunrise = datetime.fromtimestamp(forecast.weather.sunrise time()).strftime("%H:%M:%S")
#print(sunrise)
time = sunrise.split(":")[0:2]
hours = int(time[0])
minutes = time[1]
day = " "
if hours < 12:
if hours == 0:
hours = 12
hours = str(hours)
day = "AM"
else:
day = "PM"
if hours != 12:
```

```
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hours -= 12
hours = str(hours)
minutes = time[1]
sunrise = hours + ":" + minutes + day
sunset = datetime.fromtimestamp(forecast.weather.sunset_time()).strftime("%H:%M:%S")
#print(sunset)
time = sunset.split(":")[0:2]
hours = int(time[0])
minutes = time[1]
day = " "
if hours < 12:
if hours == 0:
hours = 12
hours = str(hours)
day = "AM"
else:
dav = "PM"
if hours != 12:
hours -= 12
hours = str(hours)
minutes = time[1]
sunset = hours + ":" + minutes + day
temperature = str(forecast.weather.temperature('celsius').get('temp'))
uvi = forecast.weather.uvi
message = "Here is the Weather:\nToday will be mostly " + detail status \
+ ", humidity of " + humidity + " percent" \
+ " and a pressure of " + pressure + " millibars" \setminus
+ ". The temperature is " + temperature + " degrees" \
+ ". Sunrise was at " + sunrise \
+ " and sunset is at " + sunset \
+ ". " #+ self.uv_index(uvi)
# print(message)
```

print(message return message

I CHATGPT, THEREFORE I AM: TRANSFORMING EDUCATION WITH AI: OPPORTUNITIES AND CHALLENGES AHEAD

Constantine ANDONIOU

Introduction

The increasing attention towards the emergence of Artificial Intelligence (AI) and its influence on education is causing further upheaval in our established methods of teaching and learning. in order to comprehend the effects of AI chatbots on education, it is crucial to initially grasp the distinctions between human intelligence and artificial intelligence. to exemplify the differences between the two, the discussion focuses on aspects of the nature of human intelligence, the communication processes in the human brain, and the concept of consciousness, an understanding of how AI chatbots work and their impact on teaching and learning, potential benefits and disadvantages of AI-enabled education, and also some challenges and threats to education. The discussion concludes with a reference to the ethical considerations of using AI tools in education, including academic integrity, privacy and safety and intellectual property. Ultimately, the paper aims to contribute to the ongoing discussion surrounding the integration of AI in education while highlighting its potential benefits and ethical concerns.

The Nature of Human Intelligence

Human intelligence is a complex concept which has been defined in several ways, from the ability to use reason and problem-solving to the ability to learn and think in abstract and creative ways. The General Intelligence Factor (g-factor) theory, proposed by Spearman in 1904, postulated that intelligence can be measured by standardized tests of cognitive ability, a that view has been widely debated, with theorists arguing that intelligence is composed of multiple abilities expressed as many types of intelligence (Wilson, 2017).

Since then, cognitive neuroscience models of intelligence have shed some insight in the mechanisms underlying human intelligence, revealing various cognitive processes related to specific brain regions and neural networks and how they interact to support higher-order thinking and problem-solving. Although intelligence can predict academic and professional success, it is often subject to social and cultural biases, therefore it is important to recognize ex-

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isting limitations and to adopt a more comprehensive and inclusive approach to understand human intelligence which is the product of the diverse ways in which people learn, reason, and engage in problem-solving.

What is intelligence

Intelligence can be seen as behavioral, neurological, physiological, or social. Intelligence is not an entity that exists on its own, rather it is an active and interpersonal process that is demonstrated through human thoughts and actions. It is relational in nature, resulted by how it is executed, the physical form it is expressed by, and the people involved. It is not limited to the brain, rather is one of the many ways we interact with the world around us, serving as a gateway to make something tangible (Popova, 2023).

How the human brain communicates

Research on brain activity concluded that the human brain exists in a state somewhere between stability and chaos as we try to make sense of the world. The human brain shifts from one semi-stable state to further multiple states, through chaotic, unpredictable and volatile transitions in seemingly completely random patterns. Specific brain networks seem to inter-relate and interact in an alternate state of one 'listening' while the other is 'speaking' (Hamzelou, 2023).

Is the brain a quantum computer?

Although neuroscientists have a good understanding of where consciousness originates, they are still trying to understand exactly why consciousness exists, or, what it is. Using modified MRI machines, physicists believe they have found *quantum entanglement* in the human brain which may result in the rise of consciousness. Entanglement is a theory central to quantum mechanics that explains the connection among entangled particles shows properties that are seemingly in two states at once (Farah, 2022).

Understanding Artificial Intelligence

Advances in computer science, mathematics, and neuroscience, and the availability of large datasets and powerful computing resources, has led to the gradual, and recently exponential rise, of artificial intelligence technologies. The purpose of AI machines is to carry out tasks that would normally necessitate human cognitive abilities, including perception, learning, reasoning, and decision-making.

AI systems that are specifically programmed for particular tasks, such as image recognition or natural language processing, are classified as *Narrow AI* systems based on machine learning algorithms that learn from large amounts of data (Rouse, 2022). *General AI* remains a hypothetical concept with important technical and ethical challenges; it refers to machines that can perform human intellectual tasks and that can learn and reason like humans do (Lutkevich,

2023). AI systems have the potential to bring significant benefits to society but there are a lot of technical, ethical, and social dimensions to consider during their implementation which require transparency, accountability, and responsible innovation.

Artificial intelligence has always been thought to be superior to human intelligence. An AI system is undoubtedly faster in a lot of aspects and can accomplish tasks only in a few minutes when a human would take much longer to process. Artificial intelligence can only learn if it is fed certain amounts of data. The difference between AI and human intelligence is that humans can think and learn from past experiences, can be both objective and subjective, with a wider perspective to make decisions. Artificial intelligence, on the other side, can make decisions strictly consulting numbers and can only 'infer' based on the data being available (Pierce, 2021).

How AI works

AI developers are unable to explain how AI works and to determine its outputs. A lot of AI systems are developed with the principle of *universalism*, which holds that a system is considered effective if it can function universally, for everyone, and at all times. (Wikipedia.com, 2023b; Goffi, 2022).

Deep Neural Networks (DNNs) are composed of layers of processing units trained on human-generated data to imitate the neural networks of the human brain, and frequently display a similar level of inscrutability. in most cases, AI systems are regarded as black box models since they are only understood in terms of their inputs and outputs. Moreover, the data used to train AI systems frequently contain inherent biases that mirror the racial and gender biases present within our societies. Deep learning models include Generative Adversarial Networks (GANs), which are most often used to train generative AI models. Developers create models but often cannot fully explain how they work. It seems they put trust in a system simply because it gives answers that fit what one is looking for, but they fail to ask key questions about the reliability and authenticity of the responses, or about the accountability and responsibility in case of possible harm by the responses given (Xiang, 2022).

AI and consciousness

There has been an understandable and justifiable panic over the emergent tendencies of AI chatbots to be an indication of evolving consciousness, which in order to resolve it one needs to understand the nature of human consciousness itself (Harrison, 2023). The confusion about AI chatbots' emergent properties lies in our misunderstanding of the relationship among information processing, intelligence, and consciousness. Humans tend to project personality and consciousness onto anything with complex behavior. A chatbot is not

feeling anything and that is because it has no physical body, therefore no source of feeling states or emotions.

A human is filled in with memories of embodied experiences that no logical or computational complexity can produce. The foundation of consciousness is based on what philosophers called *conatus* or *striving*, or what neuroscience calls *seeking* or *wanting*, all based on a feeling-based motivational system, without which information processing has no purpose, direction, or even meaning. Biology and psychology also describe how the physical body gives meaning to informational exchanges. in the case of artificial intelligence, information processing is based on algorithms and binary logic, without any awareness, feeling, or intention (Asma, 2023).

There is a dark side of AI chatbots like ChatGPT that needs to be addressed. ChatGPT has been violent, sexist, and racist. Scientists have long been sounding the alarm about the bias within the algorithms in social media to which ChatGPT is not immune either. It is no surprise that AI chatbots can generate biased responses as they only mirror what they have been programmed and what they have been trained on (Asare, 2023).

Artificial hallucination

AI analysts indicated that frequent hallucination is a major problem in LLM technology. OpenAI's ChatGPT, Google's Bard, Microsoft's Bing AI all appear to contain many instances of artificial hallucination that goes undetected by users (Thejesh, 2023). An *artificial hallucination* (also called *delusion*) is a confident response by an AI bot that does not seem to be justified by its input source (Wikipedia.com, 2023a). AI bots hallucinate and present you with data which look very real but they are only made up, creating fake news or fiction. None of the generated responses exist or correspond to facts.

Human Intelligence vs. Artificial Intelligence

Human intelligence involves cognitive abilities possessed by humans which are the product of biological evolution and incorporate both genetic and learned skills and knowledge. Human intelligence can perceive and interpret complex patterns, form judgments based on context and prior experience and human cognition, it can adapt to new conditions and learning experiences. Human intelligence is formed through lifetime learning and experiences. Selfawareness and consciousness are characteristics of human intelligence which underpin the sense of identity, emotions, and moral reasoning.

In contrast, AI is a product of technological advancement and innovation and is based on large data sets and algorithms. AI systems can process large amounts of data quickly and accurately, but they lack the flexibility and creativity of human cognition. AI systems are programmed or trained to learn from data using machine learning algorithms and they can present problems in accuracy and effectiveness of produced output. AI systems lack subjective consciousness and are purely functional in nature.

How Ai Is Disrupting Education

Large Language Models (LLMs) are revolutionizing education and are already having a great impact in transforming learning and teaching. LLMs can generate intelligible and human-like text, which can be used for various applications in education. Moreover, as in the case of ChatGPT, these models are used for the development of chatbots and virtual assistants, predominantly to assist the learning process or provide customized support and personalized feedback.

How AI chatbots work

ChatGPT is an AI-powered chatbot which works by using natural language processing and machine learning algorithms to interpret questions and provide answers and personalized recommendations. in essence, AI chatbots are intended to help improve academic performance by supporting studying and identifying areas of skill improvement and knowledge gaps. One area that is definitely effective, is time management and reduction of workload hours (Mallow, 2023). OpenAI has been improving ChatGPT with a launch of plugins extending the bots functionality by granting it access to third-party knowledge sources and databases, the release of ChatGPT Plus and GPTchat-4 (Stringer & Wiggers, 2023).

How AI chatbots disrupt education

The capabilities of AI, as demonstrated by OpenAI's ChatGPT, indicate its potential to handle tasks that have conventionally been associated with 'knowledge work.' As a result, this often leads to the development of entirely new systems, along with novel business models, job opportunities, and workflows. As AI tools, such as ChatGPT, continue to improve, they have the potential to take over certain jobs traditionally demanding repetitive and creative tasks, jobs that can be automated (Agrawal et al, 2022). The new generative language models, are being integrated in all kinds of applications and are assisting people to perform time-consuming tasks faster and in many cases more creatively. AI systems are affecting existing work structures, task workflows, consequently they generate a lot of debate about their application in education and their impact on human thinking or even existence.

The impact of AI chatbots in teaching and learning

ChatGPT's generated output is of seemingly good quality, although often of questionable validity and reliability; its training datasets consist of trillion of words (from Wikipedia articles and millions of books and websites) almost exclusively of English-language. ChatGPT, and other AI tools, have created a dystopian panic over the entire academic world, from K12 schools to universities.

OpenAI's ChatGPT chatbot is trained with machine learning to simulate human-like conversations, and in its initial version, it was designed to assist students and academic professionals in enhancing their writing processes. A significant disruptive potential of ChatGPT with regards to academic writing processes is its capacity to serve as a smart writing assistant, aiding students in organizing and expressing their ideas, and improving their writing style and grammar. However, one of the primary concerns regarding chatbots is their inability to replicate the profound analytical skills and critical thinking abilities of humans. Furthermore, there are concerns about chatbots being unable to account for cultural and linguistic diversity, as well as issues pertaining to privacy and security.

Many universities are considering *Algiarism* (Crossplag.com, 2022) and introducing systematic plagiarism detection software and in extreme cases they are banning ChatGPT and AI tools or returning to paper-based examinations. One major concern is over *structural plagiarism* in which existing text is intentionally distorted using AI-powered paraphrasing tools to hide the source from detection by plagiarism-detection software. As a result, one of the prevalent questions in higher education regards the nature of fundamental qualitative changes that can be expected from the future collaboration of human and artificial intelligence in academia.

The question rises whether AI-supported writing tools should be used proactively in the classroom to ultimately assist to generate higher quality work via the automated creation of initial draft texts and the subsequent *manual* optimization of the texts. If so, the question moves to how should we use these tools and what knowledge and competencies do students and teachers need? A far more difficult question refers to the assessment of academic work that is the result of *human-machine co-production*. The solution may lie in assessing not the final product but the quality of the *process* that was followed to reach to the final product (Weßels et al, 2023).

Pros and cons of Artificial Intelligence

Although still in its embryonic stage of development Artificial Intelligence (AI) has rapidly become a dominant technology and it offers a variety of advantages. One of the most significant benefits of AI is its ability to save time and potentially reduce risks. AI offers a notable advantage in terms of cost-effectiveness as it is typically less expensive to use AI machines than to rely on human labor. This means that companies can save money by utilizing AI for tasks that would have otherwise required a significant amount of human resources. Additionally, AI has the ability to aid in idea generation due to the vast amounts of information available to AI tools which they can process quickly. This allows for the possibility of generating insights and ideas that may not have been considered by humans.

However, it is important to note that AI also has its downsides, one of which is its incapacity to evoke human emotions. AI-generated content lacks the human touch and emotions, resulting in a blunt and unappealing output. AI writing can also be incoherent, lacking an emotional touch and logical flow. This lack of coherence can affect the readability and comprehension of the output. Additionally, AI-generated content often lacks personality. Typically, human writing has emotions, passions, fun, excitement, and sarcasm, which AI cannot replicate. Another disadvantage of AI is the reliability of its accuracy. AI lacks updated information and can fabricate responses. Therefore, it is unreliable in certain circumstances and can produce inaccurate or misleading results (Smith, 2023).

Benefits and Challenges of Ai-Enabled Education

Are AI chatbots a threat to Higher Education?

If you believe the hype, ChatGPT has been considered by many the latest threat for higher education. What, those who believe so, fail to acknowledge, is that software and ghost-writing services for student assignments, such as solving math problems and writing college essays and research papers, have been around for many years and used extensively by students and university teachers.

ChatGPT in its current form can generate seemingly correct answers based on the given input but in general does not have the ability to truly comprehend the meaning of what is producing, meaning that any responses it generates are likely to be shallow and lacking in depth and insight. One way to be used efficiently and productively in education is to ask students to work around AI generated content and add their own insights and even correct any inaccuracies, often common with ChatGPT. It is well known by now that ChatGPT makes things up when asked, it can produce content that sounds plausible and even supported by citations which turn out to be bogus (Wingard, 2023).

Pros and Cons of reliance on AI generative models in education

The development of advanced AI generative models like LLMs has raised concerns about their impact on human cognitive skills. As these technologies continue to advance, there is a possibility that they could lead to the emergence of entirely new cognitive abilities that we have yet to see. Is it going to lead to a heightened ability of users to process and understand complex information at an accelerated rate, or quite the opposite, reduce human critical thinking and judgement to a basic and simplistic way to understand and explain things?

One of the significant advantages of LLMs like ChatGPT is their ability to quickly comprehend complex information, process and synthesize data from multiple sources, and provide tailored information presentation, which gives them an edge over traditional search engines and other sources. Still, will LLMs enable users to enhance the ability to think creatively and solve complex problems, or will they 'kill' human creativity and reduce problem-solving abilities as these are now done by advance AI systems? Undoubtedly AI can generate diverse potential solutions and evaluate their effectiveness in real-time, but of what quality and at what cost of human productivity?

There is also a concern that over-reliance on LLMs may negatively impact creative thinking and problem-solving skills, leading to a decline in critical thinking and independent thought. It is important to see LLMs and AI tools as tools rather than a source of solutions to all our answers. LLM produced content can be used as a starting point to engage our own critical thinking and problemsolving processes.

LLMs and AI chatbots have serious limitations related to validity, reliability, bias and more (Safjan, 2023). The issue of bias is particularly evident in popular AI image-generating systems, which tend to amplify harmful biases and stereotypes. Researchers have examined the biases in three popular AI image-generating models: DALL-E 2 and two versions of Stable Diffusion (Heikkilä, 2023; Luccioni et al, 2023). What they found is that the models tended to produce images of people based on certain existing cultural and social stereotypes regarding gender, ethnicity, professions, identity or social ranking. This problem is becoming more pressing as these models become more widely adopted and produce increasingly realistic written or visual content. One of the reasons for this is that these models are typically trained on US-centric data, which means they mostly reflect American associations, biases, values, and culture (Luccioni et al, 2023).

One more concern regards security and privacy of AI trained data, consequently the validity and reliability of the generated results. One study showed how vulnerable AI datasets can be to any attacker who can access a number of URLs that could be used to inject ill-informed information into a set of AI training data. Researchers demonstrated that it was possible to generate a backdoor that could deliberately misclassify images by altering the AI models training data (Stokel-Walker, 2023).

Transforming Education With Ai: Innovation and Ethics

AI chatbots and the rise of AI writers

AI learning has reached a high level of innovative sophistication with obvious ethical implications for higher education that need to be confronted fast. Many argue that we need to embrace these tools and integrate them into paedagogies and policies towards a sustainable future. At the same time, academic integrity is at stake with AI tools like ChatGPT. Universities need to think of, and develop, alternative types of assessments incorporating AI-generated content. Using ChatGPT to write an essay is different from hiring a ghost writer as this is free (conditions apply), instant and undetectable by plagiarism software. ChatGPT is forcing the issue of assessment to shift to the process. Initially, universities need to notify faculty about the capabilities of AI-generated text and update academic integrity policies (Gleason, 2023).

Academic integrity in the era of AI

With the rise of AI powered applications for education, like chatAPIs and ChatGPT, academic integrity has become an issue of serious concern in all levels of education. The use of chatAPIs and ChatGPT in higher education offers many potential benefits, such as increased student engagement, collaboration, and accessibility. One of the main advantages of AI language models is that they provide a platform for asynchronous communication, which can increase student engagement and collaboration. (Li & Xing 2021). Other possible opportunities include personalized assessments and the creation of interactive, game-based assessments, or even using AI to grade essays or other written assignments, freeing up instructors to focus on more high-level tasks like providing feedback and support to students (Cotton et al, 2023).

However, these tools also raise several concerns, particularly in relation to academic honesty and plagiarism. There is the potential for dishonesty on behalf of students by (mis)using AI-powered systems in course assignments or exams. It has become increasingly difficult for educators to monitor and prevent such AI-based unethical practices. Educational institutions are trying to balance the leveraging of educational quality using AI with ensuring practices of academic integrity. AI-powered plagiarism detection tools, utilized by educational institutions, are not foolproof and they do not offer a satisfactory solution to academic cheating, as educators continuously try to adapt their strategies to stay ahead of tech-savvy students. Academic institutions need to invest in awareness and training on the ethical use of AI-powered tools, alongside with adjusting and upgrading academic integrity policies, and employing innovative assessment and monitoring strategies to combat AI-driven academic dishonesty (Çubukçu Çerasi & Balcioglu, 2023).

An extensive and sustainable set of strategies, addressing future actions to deal with AI in teaching and learning, should include: an emphasis on the position and juxtaposition of human agency to the AI-driven systems, an alignment of such systems to a clear and feasible vision of educational goals, the design of educational systems using advanced technological systems and associated learning principles, a prioritizing of embedding trust in artificial systems, the awareness and active involvement of educators, a focus on research and development addressing the impact of AI-driven systems in learning, and the development of education-specific guidelines how to cope with current and future developments (Cardona et al, 2023).

Challenges of AI for assessment in education
Numerous cases of academic dishonesty using AI tools are emerging at an increasing rate. The plagiarism detection bypass is a technique in which students may use AI tools to paraphrase or rewrite plagiarized content, this way evading conventional plagiarism detection systems, and submitting unoriginal work. Automated essay generators use AI to produce essays on a variety of topics, thus enabling students to submit essays created by machines as their own. Some AI chatbots are used for cheating in online exams using voice recognition which assists students in real-time to access prohibited resources or receive answers discreetly. Students are also able to hire AI-driven ghostwriting services to produce academic papers, which they then submit as their original work, undermining their own learning. Finally, there are numerous AI-based apps which use algorithms to automatically summarize academic articles or papers, which are then used by students without understanding the content and/or misrepresenting their comprehension of the material.

Academic faculty can employ various strategies to prevent Algiarism using AI chatbots such as ChatGPT. Firstly, educating students on the importance of avoiding plagiarism is crucial. Secondly, requiring students to submit drafts of their work for review before the final submission can prevent plagiarism. Additionally, using AI-generated text, and plagiarism, detection tools can help identify and address any instances of cheating. to avoid misuse of ChatGPT and other resources, clear guidelines and policies should be established. Examining patterns or irregularities in the language can also be helpful in detecting plagiarism. Moreover, verifying sources and citations, checking for originality, factual errors, grammar, and spelling are all important steps in avoiding Algiarism.

Finally, it is essential to recognize that writing generated by AI may lack the contextual awareness and responsiveness that human writing possesses. As a result, it may be less effective and clear in conveying information to the intended audience (Cotton et al., 2023).

The ethical use of AI

The United Nations Educational, Scientific and Cultural Organization (UNESCO) urged its world member to establish a set of global norms to respond to the development and use of Artificial Intelligence (UNESCO, 2022). UNESCO's recommendations for the ethical use of AI included: the provision of adequate AI literacy education, the promotion of the acquisition of 'prerequisite skills' for AI education and the development of AI ethics curricula for all levels along with awareness programmes about AI developments, the encouragement for research initiatives on the responsible and ethical use of AI technologies based on participation and equity, and the critical evaluation of AI research to help advance scientific knowledge and practice of AI technologies. A protective framework from AI potential harm by setting a set of universal rules is a legitimate idea and would benefit the future of humanity, still, there are concealed problematic preconceptions regarding the relevance of a universalist approach as the outcome of such an endeavor is highly unpredictable due to the nature of AI itself, as well as, the universal agreement and understanding of it (Goffi, 2022).

The integration of AI systems in education needs to be contextualized. Educational institutions should assess the exact teaching and learning needs and challenges, rather than implementing AI solutions randomly and indiscriminately. Within this context AI-powered applications and tools should be used to enhance, and not replace, teaching and learning by humans. AI for adaptive learning can be leveraged by the personalization of educational content to individual students' learning needs, while respecting their privacy and learning preferences.

Transparency of AI operation and institutional accountability should be a priority. Educational institutions should be liable for the outcomes of AI-powered interventions and specific measures should be implemented to address bias and errors on behalf of AI systems. This can be accomplished by ensuring transparency in the use of AI algorithms and decision-making processes. to avoid AI bias and promote inclusivity, diverse teams – in terms of learning styles, languages, and abilities, should be involved in the development of AI applications.

Measures need to be taken by educational institutions to protect data privacy and security. Both student and staff data and privacy rights should be protected, by implementing strong cybersecurity measures to safeguard sensitive information collected by AI systems.

There should be continuous monitoring and evaluation of the impact of AIpowered tools in the educational process. Feedback from students, teachers, and related stakeholders can be used to adjust and improve the compliance and alignment of AI systems with the intended educational goals. Regular ethical audits of AI systems operation should be conducted to identify potential diversions and unintended biases that the systems may develop as they evolve.

Two important issues arising from the AI evolution are those of AI literacy and ethical use and implications. Awareness and training are needed, not only for students but also for teachers, administrators, and parents. Additionally, institutions should foster international collaboration sharing best practices and research findings regarding the responsible and ethical use of AI. They should also empower students by providing training on AI ethics and encouraging critical thinking and ethical decision-making when using AI tools in their learning endeavors.

The ambiguity of AI-creative authorship

One last important topic. that is often and largely ignored, is the issue of AI mixed media and the ambiguity of creative authorship when using these tools. Generative AI-generated content is undoubtedly growing, still there is uncertainty over the issue of intellectual property (IP) of this content. in March 2023 the US Copyright Office stated clearly that if a work's elements of authorship were produced by a machine, then the work lacks human authorship and the Office will not register it. This simply means that any AI produced content will not be protected by copyright if it was created by humans using only a text description or prompt. in other words, if you are generating content using AI tools, you do not own any of it.

In addition to the IP of generated content, there is also the issue of fair use, with artists taking legal action against popular generative AI tools for allegedly using copyrighted images to train their AI models without obtaining permission or compensating the artists. If a court rules in favour of these artists, and one happens to be using generative content produced by these tools, then they may find themselves having to pay IP royalties or artist compensation on products that are already on the market (DelSignore, 2023).

Conclusion

As we navigate in the unpredictable and rapidly volatile territory of AI systems integration in education, it is of critical importance to maintain a well-balanced logical mind between advanced technological progress and ethical considerations regarding the use of such technological advancements. One popular way to think about it is that of the human race about to succumb to the 'roboapocalypse,' or the domination of machine artificiality and annihilation of humanity. Another, more productive and positive approach would be to look at a controlled AI that is shaping a future where our educational experiences are enhanced and evolved while at the same time we preserve our human standards and intellectual development.

In this context, some forward-looking recommendations would include the following considerations. Empower student digital citizenship by developing an ethics-based AI curriculum for the responsible use and implications of AI systems. Implement continuous monitoring systems and regular assessments to ensure that AI systems adhere to required standards (including ethics and bias). Focus and prioritize on the principle of AI systems being tools in assistance of humans rather than aimed to replace them. Some of the educators' administrative or other routine tasks can be automated, allowing them to focus more on their teaching and student development. Encourage public and open dialogue, and research on the impact of AI in education, while fostering AI-driven technological innovation that prioritizes student learning outcomes and ethical considerations. Provide professional development for educators on

understanding and using AI tools effectively. Ensure that such AI tools are designed for an inclusive education in mind, and are catering for diverse learning requirements and aptitudes. These and more recommendations that arise from this emerging domain of AI-driven educational activities should aim to harness the potential of AI to enhance education while maintaining our fundamental principles which define us as human thinking entities. AI can complement our cognitive abilities, augment our learning, and support us a more inclusive and equitable future of education.

French mathematician and philosopher René Descartes stated in 1637 that the fact one is thinking, or doubting their own existence, it is actually a proof of their existence (*cogito, ergo sum: I think therefore I am*). That was a piece of foundational knowledge that cannot be doubted, human thinking demonstrating the attainability of knowledge. Years later we find ourselves at the brink of a new era where Artificial Intelligence is emerging as our new driver of knowledge and thinking. We are forced to prove and justify our existence by complying to the advances of technology, namely AI, to have our human thinking and all the qualities that go with it, challenged, to be modified and/or replaced by cold, blunt, biased algorithms and an emerging franken-consciousness of artificiality and biased-illusion. It is just the beginning of an unknown, volatile and dangerous future towards the domination of the machine and disappearance of humanity. Unless. to be continued...

References

- Agrawal, A., Gans, J. and Goldfarb, A. (2022). ChatGPT and How AI Disrupts Industries. Retrieved from: https://hbr.org/2022/12/chatgpt-and-how-ai-disrupts-industries
- Asare, J.G. (2023). The Dark Side of ChatGPT. Retrieved from:
 - https://www.forbes.com/sites/janicegassam/2023/01/28/the-dark-side-of-chatgpt/
- Asma, S. (2023). Calm Down. There is No Conscious A.I. Retrieved from: https://gizmodo.com/aichatbot-bing-chatgpt-there-is-no-conscious-ai-1850157657
- Cardona, M.A. et al. (2023). Artificial Intelligence and the Future of Teaching and Learning.
- U.S. Department of Education, Office of Educational Technology.
- Cotton, D., Cotton, P.A. and Shipwa, J.R. (2023). Chatting and Cheating. Ensuring academic integrity in the era of ChatGPT. Retrieved from: https://doi.org/10.35542/osf.io/mrz8h
- Crossplag.com (2022). What is Algiarism? Retrieved from: https://crossplag.com/what-is-aigiarism
- Çubukçu Çerasi, Ceren & Balcioglu, Yavuz. (2023). A Review on Academic Integrity and the Use of Artificial Intelligence in Education from 2012 to 2022. 10.5281/zenodo.7744434.
- DelSignore, P. (2023). AI and the Law: What You Need to Know The AI Topic Nobody Is Talking About. Retrieved from: https://medium.com/the-generator/ai-and-the-law-what-you-need-toknow-bfebb51b7d53
- Farah, T. (2022). Is the brain a quantum computer? Retrieved from: https://www.salon.com/2022/11/30/is-the-brain-a-quantum-computer-a-remarkable-pair-ofstudies-suggests-so/
- Gleason, N. (2023). ChatGPT and the rise of AI writers: how should higher education respond? Retrieved from: https://www.timeshighereducation.com/campus/chatgpt-and-rise-ai-writershow-should-higher-education-respond
- Goffi, E.R. (2022). The dangerous universalist grounds of 'AI ethics'. Retrieved from: https://www.theyuan.com/419/The-dangerous-universalist-grounds-of-AI-ethics.html
- Hamzelou, B. (2023). Neuroscientists listened in on people's brains for a week. They found order and chaos. Retrieved from: https://www-technologyreviewcom.cdn.ampproject.org/c/s/www.technologyreview.com/2023/02/07/1067951/brains-weekorder-chaos/amp/
- Harrison, M. (2023). Microsoft Researchers Claim GPT-4 Is Showing "Sparks" of AGI. Retrieved from: https://futurism.com/gpt-4-sparks-of-agi
- Heikkilä, M. (2023). These new tools let you see for yourself how biased AI image models are. Retrieved from: https://www.technologyreview.com/2023/03/22/1070167/these-news-tool-let-you-seefor-yourself-how-biased-ai-image-models-are/
- Luccioni, A.S., Akiki, C., Mitchell & M. Jernite, Y. (2023). Stable Bias: Analyzing Societal Representations in Diffusion Models. Retrieved from: https://huggingface.co/spaces/societyethics/StableBias
- Lutkevich, B. (2023). Artificial general intelligence (AGI). Retrieved from: https://www.techtarget.com/searchenterpriseai/definition/artificial-general-intelligence-AGI
- Mallow, J. (2023). ChatGPT For Students: how ai chatbots are revolutionizing education. Retrieved from: https://elearningindustry.com/chatgpt-for-students-how-ai-chatbots-arerevolutionizing-education
- Pierce, R.J. (2021). Artificial Intelligence vs. Human Intelligence: How Do They Differ? Retrieved from: https://www.techtimes.com/articles/263318/20210724/artificial-intelligence-vs-humanintelligence.htm
- Popova, M. (2023). Ways of Being: Rethinking Intelligence. Retrieved from: https://www.themarginalian.org/2023/01/26/james-bridle-intelligence/
- Rouse, M. (2022). What Does Narrow Artificial Intelligence (Narrow AI) Mean? Retrieved from: https://www.techopedia.com/definition/32874/narrow-artificial-intelligence-narrow-ai
- Safjan, K. (2023). New Cognitive Skills in the Age of AI Tailored Information Presentation. Retrieved from: https://safjan.com/pros-and-cons-of-reliance-on-ai-generating-models/#pros-and-consof-reliance-on-ai-generating-models
- Smith, N. (2023). Should You Let AI Write Your Essay? 4 Pros & Cons. Retrieved from: https://www.weirdworm.com/proa-and-cons-of-ai-essay-writing/

- Stokel-Walker, C. (2023). You can poison AI datasets for just \$60, a new study shows. Retrieved from: https://www.fastcompany.com/90859722/you-can-poison-ai-datasets-for-just-60-a-newstudy-shows
- Stringer, A. & Wiggers, K. (2023). ChatGPT: Everything you need to know about the AI-powered chatbot. Retrieved from: https://techcrunch.com/2023/03/23/chatgpt-everything-you-need-toknow-about-the-ai-powered-chatbot/
- Thejesh, G.N. (2023). ChatGPT Hallucinates. Retrieved from: https://thejeshgn.com/2023/03/18/chapgpt-hallucinates/
- UNESCO (2022). Recommendation on the Ethics of Artificial Intelligence. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000381137
- Weßels, D., Mundorf, M. & Wilderm, N. (2023). AI in education: ChatGPT is just the beginning. Retrieved from: https://the-decoder.com/ai-in-education-chatgpt-is-just-the-beginning/
- Wikipedia.com (2023a). Hallucination (artificial intelligence). Retrieved from: https://en.m.wikipedia.org/wiki/Hallucination_(artificial_intelligence)
- Wikipedia.com (2023b). Universalism. Retrieved from: https://en.wikipedia.org/wiki/Universalism
- Wilson. L.T. (2017). Spearman and the Theory of General Intelligence. Retrieved from:
 - https://explorable.com/spearman
- Wingard, J. (2023). ChatGPT: a threat to higher education? Retrieved from: https://www.forbes.com/sites/jasonwingard/2023/01/10/chatgpt-a-threat-to-highereducation/
- Xiang, C. (2022). Scientists Increasingly Can't Explain How AI Works. Retrieved from: https://www.vice.com/en/article/y3pezm/scientists-increasingly-cant-explain-how-ai-works

THE ROLE OF AI IN EDUCATION: EXPLORING CREATIVITY THROUGH CHATGPT

James LAYTON - Stephen LANGSTON

Introduction

In the 2001 Spielberg film AI, set in the 22^{nd} century, an artificially intelligent child, capable of experiencing emotions such as love, is given to a couple whose human son has been placed in suspended animation. When the real child returns home, the AI copy is sent away. Two thousand years later, when humanity has been finally destroyed, the AI child is used as a source of knowledge about humans. Here, 'the machine outlived humanity, but machines still need humans (or as close as possible to human) to understand feelings and emotions. The relationship between humans and machines is a necessary part of living in the 21st century' (Layton, 2022). We live in an age where it is possible to retrieve masses of information from the World Wide Web through a complex network of exchanges between artificially intelligent machines. Whilst we may never reach the dystopian world view of Spielberg's AI, artificial Intelligence is set to revolutionise all aspects of life, including education. Bill Gates (2015) is amongst many who predict that AI will have a largely negative impact on humanity, whilst Bernard Marr (2021) regards AI as presenting new opportunities for collaboration and creativity.

For education, which has been largely absent from policy conversations (Schiff 2022), platforms such as ChatGPT present an opportunity to explore this creativity although this does not come without problems. First, ChatGPT, like most things on the Internet, collects data from its users. Without this constant mining of data, it can never become anything more than an archive of information collated by humans and, with humans, comes bias. Second, there are ethical implications to consider. As we use ChatGPT, we are contributing to these data as a form of free labour. If we can overcome these predicaments, ChatGPT could become a creative partner and a critical friend for the creative arts. Writing from the perspective of theatre and performance educators and, drawing on principles of creativity, we argue in this chapter that ChatGPT is a force for good in education. in doing so, we suggest ways in which AI can be used by students and educators to explore creativity.

Artificial Intelligence (AI) Is Defined As:

[T]he science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable. (McCarthy, 2007, p. 2)

Rather than having negative implications for education, AI can be used positively to enhance learning through creativity. As AI continues to develop, warnings are seemingly issued frequently, often relating to academic integrity, presenting AI as a threat to effective learning and assessment. in viewing it with such suspicion, however, opportunities might be missed for AI to be used positively. Instead, generative AI systems such as ChatGPT should be considered as a creative collaborator, much in the same way that one might work with a human to generate creative work. in the field of theatre and performance education, the notion of collaboration is essential in a range of contexts. For example, in most Performance-based programmes students work together which often results in a shared assessment. The COVID-19 pandemic accelerated changes in education practices and, alongside a rise in online delivery in the university sector, new technologies have been utilised to find innovative ways of engaging students in learning. Creative practices which focus on using digital skills in Higher Education have been well-documented (see Webb & Layton, 2023a; 2023b), reflecting the kind of work using technology undertaken in the creative industries more broadly (see Sermon et al., 2022; Chatzichristodoulou et al., 2022). Like the emergency response by theatre makers to the lockdowns of 2020 and 2021, where performance moved online and broadcast using accessible platforms such as Zoom in innovative ways, a similar response may be required to the way in which AI is received.¹

Theatre and technology

Technology, defined in the sense of new innovations or ways of working, has always had an influence on the theatre. Beginning with a single actor before introducing a chorus, the ancient Greek's quickly realised that staging effects could enhance the performance. Despite it being little more than a stage on wheels, the eccyclema enabled new scenes to be transported onto a stage with ease. in the English Medieval Mystery plays of the Middle Ages, 'pageant wagons' were used to move scenes around as well as creating elevated positions for the actors. When indoor lamps became the latest innovation, this technology moved theatre audiences from outdoor theatres such as The Globe to indoor playhouses like Drury Lane's Theatre Royal. in the early nineteenth century, when lime started being used to illuminate the stage, technology was literally, to use a theatrical phrase, in the limelight. Innovations throughout

¹ Some innovative examples of this include The Show Must Go Online, which staged weekly online performances of Shakespeare's plays using Zoom and YouTube to live broadcast (https://robmyles.co.uk/theshowmustgoonline/) and Creation Theatre's work (https://creationtheatre.co.uk).

the twentieth century introduced strobes, movers, LEDs, and many other tools enabling new effects. Theatre and technology, then, have always operated together; something demonstrated most recently by the industry's response to the pandemic.

Reconciling with technology

In Modern Times (1936), where Charlie Chaplin plays an assembly line worker, he is instructed to test a 'feeding machine' as part of a drive for efficiency. Although Chaplin initially keeps pace with the invention, the machine soon takes over and the human inventors have lost control. in a similar way to Chaplin's fictional machine, the drive for Socialist Realism of 1920s Soviet Russia, led theatre director Vsevelod Meyerhold to develop his system of Biomechanics as a reaction against the Naturalistic style of Stanislavski. in Meyerhold's approach, an actor's body interacts efficiently with a stage set through a series of etudes, such as in his production of The Magnanimous Cuckold (1922). in this sense, the human actor and mechanistic stage set work together creatively; to remove either element would be to produce a different effect. Certainly, for Stanislavski who was concerned with truthfulness on stage, this collaboration between human and technology might create an unnecessary tension. The struggle between humans and technology is highlighted in Elmer Rice's 1923 play The Adding Machine. in this play, Mr Zero - an accountant - learns he is being replaced by an adding machine, causing him to kill his employer in anger. Whilst this example is an extreme response to the dominance of technology, it neatly illustrates its pervasiveness in modern life.

Despite any tensions, theatre and technology have always worked in collaboration with humans, whether through fly towers, trap doors, lighting, or sound; all ways of enabling the actor to achieve more than their corporeal limitations allow. Audience expectations of big budget effects has driven the megamusical, exemplified by the barricades and helicopter found in *Les Misérables* and *Miss Saigon* respectively. When Lloyd Webber's *The Phantom of the Opera* opened in 1986, its crashing chandelier was a spectacle made possible only by technology and was part of a trend across musical theatre, where spectacular effects are relied upon, perhaps vying for attention with blockbuster films (see Baugh 2014). This drive for innovation in stage design and effects is nothing new and, in the early twentieth century it was Edward Gordon Craig, who proposed that uber-marionettes should replace human actors. Whilst Craig's vision remains proved unfulfilled, Virtual Reality (VR) has been used on stage in the twenty-first century, such as in the Royal Shakespeare Company's production of *The Tempest* (2016), where Ariel appears as a digital avatar.

AI, Creativity, and Performance

Creativity is not, of course, simply about activities such as performing, painting, or writing; nor is it concerned with the proficient demonstration of skills. Creativity can happen when someone sows flower seeds, solves a problem, or uses raw ingredients to create a new combination of flavours. Some, like Ken Robinson (2016), argue that creativity is an essential component of learning and should be integral to formal education systems, whilst psychologist Mihaly Csikszentmihalyi advocates for creativity as a means of personal enrichment. For Csikszentmihalyi, creativity 'does not happen in people's heads, but in the interaction between a person's thoughts and a sociocultural context. It is a systemic rather than an individual phenomenon' (1997, p. 23). Interaction with AI, then, changes a creative process. Runco and Jaegar (2012) offer a 'standard definition' of creativity, which 'requires both originality and effectiveness' (p. 92), whilst Hoffman et al (2016) highlight the relatively underexplored area of digital creativity. There is, however, a long tradition of using digital technologies in artmaking processes such as telematic performance, in which AI in its broadest sense (Internet, computer-computer interactions), has been important. For example, Roy Ascott's work, beginning in the 1960s, offers 'perceptive insights into the past, present and future implications and possibilities of human-machine relationships' (Shanken, 2003, p. 2). This pioneering telematic performance practice of Ascott is prescient when considering human-machine relationships such as AI.

Ascott's and others' digital work illustrates how everyday forms of AI profoundly impacts the ways in which performance, increasingly, is made in the twenty-first century. Working with such technologies is, as we argue later in this chapter, means embracing all they have to offer, including AI. in The Sadness of the Machine, Ollivier Dyens suggests that humans have come to use technology as 'memory machines' which has implications beyond work and industry, such as in recreational activities like running where devices such as Garmin watches 'become a conduit through which memories pass and are stored until reawakened by [...] viewing of the data '(Layton 2021, p. 218). By entrusting 'our memories, rather than the ability to remember, to our machines', we increasingly come to rely on technology; AI is a major part of our world and looks set to grow exponentially as we off-load 'our phenomenology onto technology' (Dyens 2001, p. 36). We will continue to live surrounded by technology, which 'has built the house in which we all live [and] [c]ompared to people in earlier times, we rarely have a chance to live outside this house' (Franklin 1990, p. 11).

Franklin's words from 1990 seem remarkably vatic if we consider that this was in the early days of the Internet as a mainstream phenomenon. The contemporary ubiquity of technology could, perhaps, have been unimaginable to Franklin and her contemporaries. Today, the Internet is far different from the vision of Tim Berners Lee who, in launching the first page on the World Wide Web in 1990, proudly stated 'This is for Everyone'. Now, it may be more accurate to state that 'This is *by* Everyone', which is particularly true of the free labour required by platforms such as ChatGPT. to constantly improve their responses, these bots *need* humans to use them; information fed by humans is utilized in refining responses to *appear* more human.

AI and its implications for pedagogy

Haenlein & Kaplan (2019) offer a balance of views in relation to the past, present, and future of AI and conclude that it will become the norm. AI has dominated the press whilst energising higher education conversations since its release as an Open AI online software resource via recent models of ChatGPT and Google's Bard. The interest lies within two areas; firstly, AI's ability to seemingly generate human-like text, graphics, software, and music, creating a piece of work based on the user's needs and demands. Secondly, concerns about the legality of use in professional environments regarding copyright material and plagiarism (Adelani et al., 2020). Large Language Models (LLMs) in Natural Language Processing (NLP) continue to develop accuracy, range, and size of abilities at an alarming rate. Consequently, AI will become highly efficient and accurate in its delivery and creativity as increased numbers of users log onto the systems. The ability to be precise increases as the AI requests feedback of accuracy from the client and the systems are in effect, learning how to 'determine'.

Higher education establishments have traditionally utilised the essay as a tool of assessment, demonstrating a student's ability to understand, research, analyse and reflect. An essay is an easy process for AI to replicate and the standard of that replication is determined by the detail submitted by the user. As the LLMs improve, the level of competence progresses and determining what is human created or AI generated will soon be impossible, rendering the traditional essay an invalid tool for assessment. AI can also do many other assessment-based tasks including lyric and song writing, advertising slogans, computer programming and even cover letters for job applications, all of which find their way into assessment categories which in turn, poses a big problem for our academic institutions. The problem is to ensure 'that AI doesn't become so proficient at doing the job it was designed to do that it crosses over ethical or legal boundaries' (Marr, 2023).

Dobrin (2023) believes that 'generative A.I is not destroying education; it is reinvigorating education in a new context. It is rewriting it'. Is it time that traditional pedagogy was replaced with new and innovative types of teaching and assessment that engages the student substantially more than a traditional process. A forced AI protective methodology will benefit the student in more ways than writing an essay. AI busting techniques include specific research resources with assessments based around localised topics saving traditional techniques such as free-range referencing for advanced and trusted postgraduate levels. of course, the art of referencing and paraphrasing remains an academic priority, but assessment should not encourage AI. in some instances, maybe it is time for a return to classroom examinations, which might mean a return to the biases which accompany traditional modes of assessment. For students with an ability to demonstrate the hallmarks of logical-mathematical intelligence by which IQ is traditionally measured, a pushback against AI might be beneficial (Gardner 2006). Continual draft assessment encourages students' progression and familiarises the marker with individuals' skills and deficiencies whilst following their process of development. Critical reflection upon personal experiences within discussions, tutorials and seminars increase a student's awareness of subject interrogation and analysis of audio and visual media takes away a reliance of written texts. However, innovative assessment strategies will not deter or eradicate AI plagiarism alone. A combination of method and strategy needs to be developed which will 'require many of us to revise – if not altogether surrender a lot of assumptions and philosophies upon which we have developed our teaching careers' (Dobrin, 2023).

Despite education being largely absent from policy conversations (Schiff 2022), many universities have already fashioned an AI usage policy which creates an interesting new dilemma; in dealing with AI, universities should be proactive and mindful of the ethical concerns when developing policy (Cotton et al., 2023). AI could be invested in as an educational resource, completely banned, or partially permitted with accountable use. in an age of ubiquitous surveillance, where students' activities are closely monitored, such as in VLE engagement and attendance, additionally monitoring AI use might be viewed as a further intrusion. Institutions should state a general AI policy, leaving localised decisions to the expert lecturers to define usage within assessment criteria. Academic integrity and plagiarism have always been seen as an important part of higher education, often with a serious face on its delivery of standing. The importance of honesty and integrity should be integrated into classroom life, its prominence in the real world emphasised with associated ethical challenges delivered as part of the continuous curriculum. Like universities, publishers should be (and increasingly are) concerned of the threat posed by AI to their business models. Whilst discussing the problem in relation to accurate use of referencing systems, Cite Them Right (Bloomsbury Publishing, 2023), has recently updated guidance on when to AI and, if used, how to cite correctly. of course, academics might also be concerned about AI replacing them, much in the same way that other industries have chosen AI over human skills.

The use of A.I technologies is not going to disappear, and only blinkered establishments will fail to encourage its students to investigate, utilise and lead in the development of this new technology. Teaching students how this technology works is just as important as utilising it. Understanding where AI gets its information from and how it is utilised is an asset to research and scholarly activity. Realising the shortfalls of current accuracy and encouraging individuals to dig deep to find original sources is an invaluable technique. However, allowing students to pass off work created by AI as their own, is just as bad as the most serious offences in plagiarism, so a balance must be established.

The future of AI and its implications for creative pedagogies

Cotton et al (2023) suggest that:

Another potential opportunity for GPT-3 [ChatGPT] in higher education is in the creation of interactive, game-based assessments. GPT-3 could be used to create chatbots or virtual assistants that challenge students to solve problems or answer questions through natural language interaction' (p. 2).

In their article, Cotton et al demonstrate the sophistication of AI, with generative AI writing the first six pages; a practice that is being used (playfully) by others (Rospigliosi, 2023) as a way of demonstrating AI's potential. For creative subjects such as Drama, Theatre and Performance, this offers interesting and exciting opportunities for enhancing creative working methods. Whilst generative AI might be a portal through which creativity is unleashed, it is important – as Rospigliosi asserts 'that we consider the ethical implications and potential risks associated with its use such as the perpetuation of historical injustices (2023, p. 2). in this sense, AI cannot demonstrate humanity or empathy towards others in the same way as sentient human beings.

Using a SWOT analysis to assess ChatGPT use in education, Farrokhnia et al (2023) list the following:

Strengths		Opp	Opportunities	
•	generating plausible responses	•	increasing accessibility of information	
•	having self-improving capability	•	facilitated personalised learning	
•	providing personalised responses	•	facilitating complex learning	
•	providing real time responses	•	decreasing teaching workload	
Weaknesses		Thr	Threats	
•	lack of deep understanding	•	lack of understanding context	
•	difficulty in evaluating quality of responses	•	threatening academic integrity	
•	risk of biases and discrimination	•	perpetuating discrimination in education	
•	lack of higher order thinking skills	•	democratisation of plagiarism in education / research	
		•	decline in higher order cognitive skills	

Table 1: Adapted from Farrokhnia et al (2023, pp. 3-9).

Whilst acknowledgement of the weaknesses and threats identified by the authors is important, we have – in this chapter - set out to demonstrate the positive potential of ChatGPT in creative education and will therefore give some attention to exploring the strengths and opportunities of ChatGPT and how these might be relevant to drama, theatre, and performance. Farrokhnia et al, in using examples of gathering feedback on an essay, show that ChatGPT might be used as a critical friend to a student. They share three examples of asking ChatGPT for feedback based on being constructive, nice, and critical, showing an ability to be specific, paradoxically, in a generalised way. Its role here as a 'conversational agent' (2023, p. 6) might prove beneficial in generating and responding to creative processes.

In what seems to be an emerging trend in writing about generative AI, we asked ChatGPT some questions based on these strengths and opportunities. in this first test, we were interested to see how well AI understands style and genre and its ability to generate plausible responses. When asked to 'Write a synopsis for a Naturalist drama', ChatGPT provided the following response, which was generated immediately.

Nature's Unseen Symphony is a poignant naturalist drama that delves into the interconnected lives of a diverse group of characters, all deeply connected to the natural world. Set in a tranquil countryside, the story unravels the beauty and complexities of human relationships while exploring the intricate relationship between humanity and the environment.

The narrative centres around Claire, an introspective and passionate botanist, who has dedicated her life to understanding and protecting the fragile ecosystem surrounding her small community. Through her eyes, we witness the transformative power of nature as she navigates personal challenges, environmental crises, and the hidden wonders of the natural world.

Claire's journey intertwines with other compelling characters: Max, an enigmatic wildlife photographer who captures both the ethereal beauty and harsh realities of the wilderness; Sarah, an empathetic park ranger who strives to balance conservation efforts with the needs of the local community; and Thomas, a young artist grappling with his role in capturing the essence of nature through his paintings.

Amidst the backdrop of environmental threats, personal conflicts, and societal pressures, the characters' lives become deeply intertwined. They form unexpected alliances, confront their inner demons, and experience profound moments of connection with the natural world.

Nature's Unseen Symphony is a thought-provoking and visually stunning drama that underscores the urgency of protecting our environment while exploring the intricate and fragile relationships between humans and the natural world. (OpenAI, 2023a)

Although ChatGPT correctly identifies that Naturalism in the theatre is concerned with people and their interactions with their environment, the content has a sharp focus on nature, with references to a 'fragile ecosystem' and a 'rich tapestry of flora and fauna'. ChatGPT's understanding of Naturalism is largely erroneous and so, as a tool for creativity, may only be partially relevant. This response demonstrates a lack of understanding of context which Farrokhnia et al identify as a potential threat to education and may also mark a decline in higher order cognitive skills. From a creative perspective, the AI generated synopsis for *Nature's Unseen Symphony* might provide a useful starting point for a writer or member of a devising ensemble.

As a second test, we asked ChatGPT to 'write a scene in the style of August Strindberg', a playwright considered to be a major figure in Naturalist theatre. ChatGPT responded with:

Scene: A Desolate Room

Characters:

- Erik: A middle-aged man, dishevelled and weary.
- Marta: A young woman, anxious and distraught.

(The scene is set in a dimly lit, sparsely furnished room. The walls are worn and peeling, revealing the decayed state of the place. A single window, covered with tattered curtains, lets in feeble rays of sunlight. Erik sits on a rickety chair, lost in thought, while Marta paces back and forth, her movements restless.)

Marta: (Anxiously) Erik, we cannot go on like this. We are drowning in this suffocating silence. I cannot bear it any longer.

Erik: (Weary) Marta, can't you see? Silence is the only language left to us. Words have become futile, empty shells. We have exhausted them, like everything else in our lives.

Marta: (Desperate) But we must break this silence! We must find a way to bridge the vast void that has engulfed us. Our souls are starving, Erik.

Erik: (Sighs) What use is it, Marta? Our souls were once intertwined, like the roots of two trees. But now, they wither and decay, unable to find nourishment in this barren land we have created.

Marta: (Frustrated) You speak in riddles, Erik. I long for clarity, for a spark of hope amidst this desolation. Can we not reach for each other, even if it means stepping on the thorns of our own insecurities?

Erik: (Bitterly) Insecurities? No, Marta, it is not mere insecurity that holds us back. It is the fear of facing the truth, of seeing ourselves stripped of the illusions we have clung to for far too long.

Marta: (Passionately) Then let us confront the truth, Erik! Let us strip away the layers of pretence and confront the raw reality that lies beneath. Only through such rawness can we discover the essence of our connection.

Erik: (With a trace of sadness) Marta, you speak with the fervour of a dreamer, but dreams, like mirages, evaporate in the harsh light of reality. We are trapped, entangled in the web of our own regrets and disappointments.

Marta: (Defiantly) I refuse to accept that, Erik! I refuse to surrender to this desolate existence we have fashioned for ourselves. There must be a way to break free, to breathe life into our stifled hearts.

Erik: (Resigned) Perhaps you are right, Marta. Perhaps there is a sliver of hope buried within the rubble of our broken dreams. But I fear that even if we find it, it may not be enough to resurrect what has long been dead.

(They fall silent, the weight of their unspoken words hanging heavily in the air. The room, once filled with the echoes of their impassioned voices, returns to its desolate stillness. Outside, the world continues its relentless march, oblivious to the plight of these two lost souls.) (OpenAI, 2023b).

Broadly, the text generated has some correlation to Strindberg's style of writing although it lacks the psychological complexity and nuance of his characters. ChatGPT has used its knowledge of Strindberg's nationality (Swedish) and therefore employed Scandinavian sounding character names. Notably, the overuse of stage direction before each line makes it less convincing as, although Naturalist playwrights such Strindberg were concerned with showing a 'slice of life' on stage, such detail was usually reserved for establishing scenic arrangements and an emphasis on removing the fourth wall (Rebellato, 2016).

A conclusion and some provocations

Based on these early experiments, it is clear to see that AI presents some interesting opportunities for creative subjects. For the theatre maker, AI can act as another member of the devising ensemble; the rehearsal room of the 21st century no longer relies on just human bodies and minds coming together to generate ideas, as a contributor in the creative process. ChatGPT only exposes the limitations of a machine's ability to think independently that Turing (1950) famously discussed but, like the boy in Spielberg's film, perhaps AI can help us be *more* human.

What is the relationship between humans and machines? We use data to structure and inform our lives (smartwatches, smartphones, smart speakers, smart homes/Internet of things, GPS), so we are already symbiotic with technology and machines. in his seminal paper in 1950, Alan Turing posed the question 'can machines think'? in doing so, Turing conjectured about the possibilities of a machine deceiving a human into thinking it is also human. At this stage of AI development, it cannot yet assume human qualities to the extent that it would pass the Turing test, as our brief experiments with ChatGPT illustrate.

The biggest debates on AI are yet to emerge and so we conclude by offering some provocations in a spirit of contributing to these discussions:

- 1. Do not rage against the machine! AI and humans can achieve more together. When the nineteenth century Luddites smashed the machines they feared would take their jobs, they merely delayed the inevitable necessary integration of humans and technology.
- 2. Use AI as a critical friend for your creativity but remember to also be critical of AI. It is important to know when AI might be wrong so trust your own knowledge and instincts.
- 3. AI is nothing without human knowledge. Use it as a mirror for understanding the world and look AI in the eye as you would any creative collaborator. AI stands on the shoulders of giants: you are that giant.

References

- Adelani, D.I., Mai, H., Fang, F., Nguyen, H.H., Yamagishi, J., Echizen, I. (2020). Generating Sentiment-Preserving Fake Online Reviews Using Neural Language Models and Their Human- and Machine-Based Detection. In: Barolli, L., Amato, F., Moscato, F., Enokido, T., Takizawa, M. (eds.), Advanced Information Networking and Applications. AINA 2020. Advances in Intelligent Systems and Computing, (pp. 1341-1354). vol 1151. Springer. https://doi.org/10.1007/978-3-030-44041-1_114
- Aronica, L. & Robinson, K. (2016) Creative Schools. London: Penguin.
- Baugh, C. (2014). Theatre, Performance and Technology. Basingstoke: Palgrave Macmillan.
- Bill Gates: Artificial intelligence is a threat to humans. (2015, January 30). The Week. https://www.theweek.co.uk/technology/62325/bill-gates-artificial-intelligence-is-a-threat-tohumane2ppcddm=true%cslid=Ciu/CAiu/5pShBhB_Eiu/AumpNU%KORECODEUDLmK_t4bAm

 $mans?ppcddm=true&gclid=CjwKCAjw5pShBhB_EiwAvmnNV8KO8EGQDFIJPUmK_t4bAmwx3CvDhIHYMgsREwenmAH64m0sJK67ExoC2kYQAvD_BwE$

- Chatzichristodoulou, M., Brown, K., Hunt, N., Kuling, P. & Sant, T. (2022) Covid-19: theatre goes digital – provocations, International Journal of Performance Arts and Digital Media, 18 (1), 1-6, doi: 10.1080/14794713.2022.2040095
- Cite Them Right online (2023) Use of artificial intelligence (AI) sources in academic work, http://dx.doi.org/10.5040/9781350928060.73.
- Creation Theatre. (n.d.). Site-Specific & Digital Theatre Company. https://creationtheatre.co.uk/
- Csikszentmihalyi, M. (1997) Creativity: Flow and the psychology of discovery and invention. New York: Harper Perennial.
- Debby RE, Cotton, P., Cotton & Shipway, JR (2023) Chatting and cheating: Ensuring academic integrity in the era of ChatGPT, Innovations in Education and Teaching International, doi:10.1080/14703297.2023.2190148
- Talking about Generative AI. Dobrin. I (2023, May 15). Broadview Press. https://sites.broadviewpress.com/ai/talking/
- Franklin, U. (1990) The Real World of Technology. Toronto: CBC Enterprises.
- Gardner, H. (2006) Multiple Intelligences: New Horizons in Theory and Practice. London: Hachette UK.
- Haenlein, M., & Kaplan, A. (2019) A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. California Management Review, 61(4), 5–14. https://doi.org/10.1177/0008125619864925
- Hoffmann, J., Ivcevic, Z., & Brackett, M. (2016) Creativity in the Age of Technology: Measuring the Digital Creativity of Millennials, Creativity Research Journal, 28 (2), 149-153, doi: 10.1080/10400419.2016.1162515
- Layton, J. (2021) (T)racing the Great North Run as a ritual process using GPS mapping, Sport in Society, 26 (2), 207-220, doi: 10.1080/17430437.2021.1996350
- Layton, J. [James Layton]. (2022, July 14). Running, my Garmin and Me [Video]. YouTube. https://www.youtube.com/watch?v=VlqJRsM8650
- Marr, B. (2021) What is the impact of artificial intelligence (AI) on society? Bernard Marr and Co. https://bernardmarr.com/what-is-the-impact-of-artificial-intelligence-ai-on-society/
- McCarthy, J. (2007) What is Artificial intelligence? Stanford University. https://wwwformal.stanford.edu/jmc/whatisai.pdf
- Myles, R. (n.d.). The Show Must Go Online. https://robmyles.co.uk/theshowmustgoonline/
- Rospigliosi, P. (2023) Artificial intelligence in teaching and learning: what questions should we ask of ChatGPT?, Interactive Learning Environments, 31 (1), 1-3, doi: 10.1080/10494820.2023.2180191
- Rebellato, D. (2016) Naturalism and Symbolism: Early Modernist Practice. in Deeney, J. & Gale, M. (eds) The Routledge Drama Anthology: From Modernism to Contemporary Performance. (pp. 3-24). London: Routledge.
- Runco, MA. & Garrett, JJ. (2012) The Standard Definition of Creativity, Creativity Research Journal, 24 (1), 92-96, doi: 10.1080/10400419.2012.650092
- OpenAI. (2023a). ChatGPT (June 26 version) https://openai.com/
- OpenAI. (2023b). ChatGPT (June 26 version) https://openai.com/

- Schiff, D. (2022) Education for AI, not AI for Education: The Role of Education and Ethics in National AI Policy Strategies, International Journal of Artificial Intelligence in Education 32, 527–563, doi.org/10.1007/s40593-021-00270-2
- Sermon, P., Dixon, S., Popat Taylor, S., Packer, R, & Satinder Gill, S. (2022) 'A Telepresence Stage: or how to create theatre in a pandemic – project report', International Journal of Performance Arts and Digital Media, 18 (1), 48-68, doi: 10.1080/14794713.2021.2015562
- Webb, A. & Layton, J. (2023a) Digital Skills for Performance: A framework for assessing current and future digital skills needs in the performing arts sector, Arts and the Market, 13 (1), 33-47, https://doi.org/10.1108/AAM-09-2021-0054
- Webb, A. & Layton, J. (2023b) It's not just about technology!: Creativity as a driving force for nurturing the development of skills for digital performance, International Journal of Performance Arts and Digital Media, 1-19. https://doi.org/10.1080/14794713.2023.2223719
- Turing, A.M. (1950) Computing Machinery and Intelligence, Mind 49, 433-460.

SUPERCHARGED: THE FUTURE OF DATA-INFORMED ONLINE STUDENT SUPPORT

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ABSTRACT

Artificial Intelligence (AI) is a term that has become a ubiquitous part of our society, almost overnight, impacting many different parts of personal and professional life. One such area is the use of data and analytics focused on student success in higher education. One university has begun to imagine the use of AI to automate the identification of online student support triggers, as well as the interventions they call for–and much more. The integration of AI creates the potential to relieve university stakeholders of mundane tasks; allowing those stakeholders to more effectively meet the evolving needs of online (and potentially on-ground) student and faculty populations. Since the integration of AI into systems supporting online students cannot be underestimated as a potential advantage in higher education, particularly with enrollment and budget challenges faced by a growing number of institutions, there remains a compelling set of reasons to consider this strategy in the near-term future.

Introduction

National Louis University (NLU) is a private, nonprofit, minority-serving institution (MSI) located in Chicago, Illinois. It has campuses in downtown Chicago; Chicago's suburbs; and Tampa, Florida, as well as an online platform. NLU has an enrollment of over 10,000 students, with 53% at the graduate level and 47% at the undergraduate level. in 2017, NLU partnered with an online program manager (OPM) company to expand its online student population. This initiative led to valuable insights about teaching, learning, and online student services, resulting in the establishment of an exemplary learning analytics framework. Implementing the OPM collaboration and its associated protocols contributed to a significant reduction in attrition rates. Consequently, NLU is now well positioned to leverage artificial intelligence (AI) to automate the identification of online student support triggers, the interventions they call for, and much more.

The case study in this chapter provides a foundation for the future of learning analytics and data mining through the application of AI. The NLU team responsible for designing the initial learning analytics system and its protocols describe the origins and current state of their extensive data repository, the data sources feeding into it, and the key student performance dashboard generated from the data. Additionally, the chapter utilizes future mapping and scenario writing to identify critical gaps and areas where the integration of AI could further optimize the system, relieve university stakeholders of mundane tasks, and meet the evolving needs of the expanding online student and faculty population at NLU and at other institutions seeking to implement similar systems.

Integrating AI into systems that support online students cannot be underestimated as a potential advantage in higher education. Given the ever-growing financial constraints faced by postsecondary institutions, it is crucial to leverage technology to serve students better. With AI in learning analytics just the beginning of this transformative journey, this chapter leaves readers with a series of scenarios and futures that become possible with the incorporation of AI into an existing learning analytics environment.

Literature Review

Learning analytics (LA) is an emerging and continuously evolving field. LA's most widely used definition is "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens, 2011, p. 34). While the analysis of information related to teaching and learning data is not novel, LA has taken center stage as the growth of online learning and the use of learning management systems (LMS)—systems where online learning takes place—has permeated university and college life. These two shifts in higher education have amassed large datasets that can be used to better understand teaching and learning and improve education and student success.

As the wide-scale use of online tools in university-level courses has grown, a rich body of data on learning in those environments has been collected that faculty, administrators, and researchers can mine. Even early on, researchers such as Firat (2016) found that using data from an LMS enabled an institution to identify "problematic aspects of the course...[to] be identified and student learning can be evaluated" (p. 76). Further, learning analytics aims to "use learner-produced data to gain actionable knowledge about learner's behavior in order to optimize contexts and opportunities for online learning (e.g., correlating the online activity with academic performance)" (Caspari-Sadeghi, 2023, p. 3). Increasingly, LA researchers have begun to believe that data analyses can help institutions of higher learning make evidence-based decisions that lead to improved student success (Gašević et al., 2014; Knight et al., 2014; Long & Siemens, 2011; Mcfayden & Dawson, 2012; Nguyen et al., 2016).

At the same time, higher education and society around the world are generally rapt with the increasing proliferation and promise of artificial intelligence. AI was defined by John McCarthy, the founding father of artificial intelligence, as "the science and engineering of making intelligent machines, especially intelligent computer programs" (McCarthy, n.d., line 3). AI can support and augment teaching and learning environments by employing intelligent and inexhaustible tutoring; intelligent agents embedded in standard software used in the higher education sector, such as the student information system and the learning management system; and intelligent collaborative learning systems in which AI could bring disparate systems into a one-stop learning space (Salas-Pilco et al., 2022). As the sector considers how, when, and where to integrate AI into everyday campus life, EDUCAUSE (Zeide, 2019) aptly pointed out as early as 2019 that some of the critical applications for institutions of higher education are:

- institutional: front-end student lifecycle support related to attracting students, admitting, and enrolling them, as well as registration and academic programming applications
- student support: support of students while they are on their academic journey, such as optimizing financial aid, guiding students through decisions related to their degree, and early-warning systems
- instructional: improving teaching practice, personalizing learning, and other supports related to teaching and learning

One can easily see significant opportunities to integrate AI into student support as one considers how much data an institution takes in and amasses during a student's life cycle: preenrollment data collected at the time of application, financial aid application information, academic behaviors, and decisions related to career outcomes. Unfortunately, most of the data exist in disparate systems that may not be mined and combined into a fuller picture of a student and what they need to persist, graduate, and obtain a rewarding career. Considering the variety and diversity of systems collecting and generating student data, it is nearly impossible for humans and even units dedicated to analysis in a university setting to make sense of or use these data for decision making (Caspari-Sadeghi, 2023). This bolsters the adage of "data rich, but insights poor" (McKinsey, 2022, p.3). Aligning to a recent McKinsey & Company report (2022), the use of AI in big data analyses will significantly accelerate the ability to consume, review, and identify issues beyond what any human could do in the same amount of time.

AI can be integrated into an institution's data repositories to help identify individualized student supports and determine personalized learning paths that teachers can adopt (Dickler, 2021). One can easily imagine just-in-time and individualized academic journeys made possible by using artificial intelligence to analyze data and determine need. Student support employees and faculty can then provide those interventions to ensure a student has the best chance at success.

Methods

With the wealth of data emanating from existing systems and the power of AI to impact decision making within an institution, the NLU team has begun considering how the university might implement and utilize artificial intelli-

gence applications in the regular course of business, mainly focusing on enhancing its data and analytics systems. to evaluate how the institution might bring AI into existing data structures and support systems, a number of potential futurist methodologies were considered. The NLU team chose future mapping and scenario development methodologies to guide the process, given their alignment with this type of current state assessment and futuristic planning process.

To increase the team's comfort with, understanding of, and ability to integrate AI, the team chose to use AI as an active participant in the method. The team used OpenAI's GPT-4 for the future mapping and scenario development process; this lauded large language model leveraged the capability and speed of AI to facilitate the team's progress.

Future Mapping

Future mapping methodology is a comprehensive framework that synthesizes qualitative and quantitative information to create a comprehensive and holistic view of the future. Future mapping's approach anticipates, analyzes, and shapes the trajectory of a future outcome. The methodology's chief power is in its expansive rather than restrictive approach that enables the exploration of multiple scenarios, the anticipation of challenges, and the opportunity to seize upon opportunities that may not have been generated via traditional brainstorming methods. According to Phillips (1996), "Future mapping is a powerful process for creating a compelling vision, deciding how to achieve it, and generating a motivation to act" (p. 10). Key elements of the methodology include:

- environmental scanning, beginning with an in-depth analysis of the current landscape (of an organization, product, or service), including social, technological, economic, environmental, and political factors. This process involves collecting data, monitoring trends, and identifying emerging patterns.
- stakeholder engagement, emphasizing the involvement of diverse stakeholders, including experts, policymakers, and representatives from various industries and communities. Their perspectives and insights enrich the process by offering different viewpoints and challenging assumptions held by the team conducting the mapping.
- foresight analysis, utilizing a range of tools and techniques such as trend analysis, horizon scanning (a part of future studies that utilizes the systematic review of potential strengths, weaknesses, and opportunities that may arise out of a particular event), and expert interviews.

Future mapping methodology uncovers weak signals (or early indications) and emerging trends that may shape the future. By identifying potential disruptions and discontinuities through foresight analysis and incorporating extensive stakeholder engagement, this methodology also enables a team to make decisions proactively and plan more strategically.

Scenario Development

Because a hallmark of future mapping is generating potential futures, the NLU team recognized that a second set of actions was needed to carefully vet each one to make the best decisions for the future of learning analytics at NLU. Because these different futures could produce wildly different results, the team chose to implement a scenario development method to describe the potential futures in more detail and provide a foundation for exploring the impact of each on student success. This was aligned to the perspectives of Rhisiart et al. (2015) in that scenario planning helps create new strategic choices for decision making as part of a disciplined future planning process.

Scenario development in this context involves an in-depth examination of each potential future with the aim of generating rich, detailed insights into the feasibility, viability, and potential impact and results of each one. A significant advantage of the technique is its flexibility and adaptability. It can be utilized in various disciplines, including social sciences, data analytics, business, education, and healthcare. The technique can also include multiple rounds of data collection tailored to suit different objectives. in this way, scenario development is akin to rapid prototyping or simulation planning, whereby a team can investigate potential futures with a proven framework meant to increase the fidelity to decision-making around those futures with the highest likelihood of success.

Key questions for the NLU team were: (a) What do these possible futures mean for the university and its students, faculty, and staff? and (b) What are the potential impacts on the use of data and on the business processes being improved by the incorporation of AI? Underpinning this process was the need to develop multiple scenarios based on different combinations of key drivers and uncertainties and then run each scenario to completion to assess its chances of success. By carefully selecting and examining each scenario, the NLU team was able to generate critical, detailed insights that contribute to a deeper understanding, draw meaningful conclusions, and help make practical decisions for incorporating AI into the institution's learning analytics environment. Incorporating GPT-4 into this process was even more helpful because it could run through the scenarios much more quickly than the team could and it could also pair the scenarios with abundant additional data that would have taken considerable time for the team to assemble. This resulted in a rich analysis of ways AI could be incorporated into NLU's learning analytics framework and how they might contribute to student success in the future-at a speed the team would not otherwise have been able to achieve. GPT-4 also expanded the team's thinking, produced results that would not have been easy to acquire quickly (e.g., expert perspectives), and provided a wealth of additional information to consider (e.g., trends the team was not aware of, weak signals the team's biases may have prevented them from clearly seeing, and a more in-depth environmental scan).

Findings

NLU has a rich history with data-informed decision making, and the learning analytics framework is no exception. The institution invested time and resources in the growth of online education to create an early warning system for online students. This system pulls data from several institutional repositories to help identify online students who may need additional support from faculty, student advisors, coaches, and learning support specialists. The NLU team utilized GPT-4 to expedite scenario building and future mapping and to explore the transformative potential of integrating AI into the existing infrastructure. Key challenges and opportunities are presented in this section, along with the ethical considerations each raises. Scenarios and potential futures were generated with an underpinning of the existing learning analytics system.

AI-Driven Early Warning Systems

Current State

Before beginning the journey of investigating how the incorporation of AI could enhance the learning analytics infrastructure at NLU, it is important to review the current state. Currently, the university gathers a wealth of data from various systems such as the customer relationship management system (Salesforce), the learning management system (D2L - Brightspace), the student information system (Banner), and the student success system (EAB). These data are fed into a vast data lake that feeds visualizations and dashboards in Microsoft PowerBI. Built upon foundational knowledge related to atrisk student behavior in the online environment, the dashboards help identify students early on who exhibit such things as (a) not logging into their courses for 72 hours, (b) missing an assignment, (c) failing an assignment, or (d) engaging at low levels, among other indicators. Figure 1 shows how the dashboard is presented to faculty and staff for their action.



Figure 1. Student Performance Dashboard

While information is available, these dashboards are not fully utilized to predict student outcomes and they do not triangulate other data that might contribute to student risk or success (e.g., preenrollment factors and financial aid information). Some attempts have been made to create predictive models. However, these models have not proven particularly effective because of the lack of internal expertise to develop such models and because past models were running on one particular system and were unable to access critical data stored in other systems. As a result, students at risk of falling behind or dropping out may only have been identified after it was too late for effective intervention.

Future State

A potential future is an AI-driven early warning system that leverages the data from various institutional repositories to identify at-risk students at a much earlier stage and also incorporate preenrollment data. AI would analyze various data points, such as student engagement, performance metrics, and behavioral patterns, to identify students who may be at risk of falling behind or dropping out in a way that humans and static dashboards would not be able to. The system could then proactively reach out to those students and alert educators and support staff, enabling those employees to intervene quickly to provide necessary assistance.

This system could also predict issues before they become significant problems, allowing preventive measures to be taken. For example, if a student is consistently submitting assignments late or not participating in online discussions, the system could flag this behavior as a sign of disengagement or struggle, prompting earlier intervention than in the existing system.

To implement this early warning system, the institution would need to integrate AI with the university's data lake (the repository where data from the various systems are pooled). AI would need to be trained on historical information to understand and interpret the data from various systems and to identify patterns and trends that indicate a student may be at risk. This could involve machine learning algorithms, which can learn and improve over time and become more accurate in their predictions. This system, however, would have challenges. A primary concern would be ensuring the accuracy and reliability of the predictions. to address this, the institution could implement a system of checks and balances in which the AI's predictions are regularly reviewed and validated by human staff. Another challenge would be ensuring the privacy and security of student data. It would be critical to implement robust data protection measures and ensure the AI is only accessing and using data in a way that complies with all relevant privacy laws and regulations.

While the current state of predictive modeling at the university is lacking, the future state, facilitated by an AI-driven early warning system, offers significant potential for improving student outcomes. By leveraging the existing infrastructure and addressing potential challenges, NLU could create a system that identifies at-risk students early and enables effective intervention. Moreover, this AI-infused learning analytics system would open up many additional opportunities (futures) to better support teaching and learning at the institution, such as (a) personalized learning paths; (b) virtual teaching assistants; c) community building and engagement; d) inexhaustible tutoring; e) career support; and (f) intelligent course development.

Personalized Learning Paths

With an intelligent early warning system, it can be easier to leverage AI to develop personalized learning paths for each student based on their strengths, gaps, and learning preferences. This type of focused learning could lead to a more effective learning experience, higher retention rates, and improved academic performance. Moreover, in today's educational landscape, both online and in-person, teaching techniques are largely standardized. Faculty follow a one-size-fits-all approach, primarily teaching to the average student, which may not cater to individual students' strengths, backgrounds, and needs.

With the infrastructure of an intelligent early warning system and further use of AI, each student could embark on a personalized learning journey tailored to their academic strengths and weaknesses, backgrounds, career aspirations, and personal interests. This scenario is particularly transformative for online learning, where technology can be leveraged to deliver a highly personalized and flexible learning experience. AI could analyze data from the university's various systems to understand each student's profile. Then it could use this information to create a customized learning map for faculty to use with each student. For example, if a student excels in hands-on, practical assignments but struggles with written reports, the AI could adjust the course content to provide more project-based learning opportunities. If a student is aiming for a career in a specific field, the AI could recommend a sequence of courses and extracurricular activities that align with the skills and knowledge required in that field as well.

This scenario would require a significant shift in the university's current systems and processes. New systems would need to be developed to deliver personalized learning experiences, and existing systems would need to be adapted to support this new approach. Additionally, the AI would need to be integrated with the university's data lake and trained to interpret data from various sources. Implementing personalized learning paths is a complex task that requires a fundamental shift in how education is delivered, from a standardized approach to a highly individualized one. This would involve significant changes to the university's culture related to teaching and learning, and potentially even the broader educational system. Another challenge is ensuring that personalized learning paths do not overemphasize certain skills or subjects at the expense of a well-rounded education. The AI needs to be programmed to maintain a balance in its recommendations, ensuring that students receive a comprehensive education while still catering to their individual strengths and interests. Despite its challenges, the potential of personalized learning paths is significant. Leveraging AI to tailor education to each student's needs could revolutionize the higher education learning experience and improve academic outcomes at-scale.

Virtual Teaching Assistants

AI-powered virtual teaching assistants could help answer student questions, provide feedback, and offer additional resources to enhance learning. This can support students outside regular classroom hours and reduce the workload of faculty and learning support specialists. At present, student queries and doubts outside of classroom hours are typically addressed through email or during office hours. While functional, this approach has limitations: responses can be delayed, particularly during peak times, and students may have to wait for clarification on critical concepts. Delays in response can hinder a student's progress and affect their performance.

Furthermore, faculty members often find themselves answering the same questions repeatedly, which can be time consuming and detract from their primary teaching responsibilities. Leveraging the AI-driven early warning system and the AI-based personal learning paths, a student could have access to a virtual teaching assistant (VTA). This AI-powered tool would be available 24/7, providing immediate responses to student queries. The VTA could be programmed with course-specific information, allowing it to answer a wide

range of common questions. For more complex queries, the VTA could direct students to relevant resources or escalate the issue to a human educator. in addition to providing academic support, the VTA could handle many administrative tasks currently performed by faculty and staff, such as automatically grading assignments based on preset criteria, tracking student attendance, and managing course schedules. This automation would free faculty and staff to focus on more value-added activities.

To implement a VTA, an institution could leverage the wealth of data available from a learning management system and student information system. These systems contain valuable information about student behavior, performance, and engagement, which could be used to train the AI. For example, the AI could use past student queries to anticipate common questions or areas of difficulty. It could also use data on student performance to provide targeted support for struggling students. That said, implementing a VTA would have challenges. For instance, ensuring the accuracy of the AI's responses would be critical, though this could be addressed by having a human review and approve the AI's responses initially, with the AI learning and improving over time. Privacy and data security would also be a priority, requiring robust measures to protect student data.

Sentiment analysis (making sense of human sentiments) and feedback could also be used in coordination with this VTA to monitor student feedback and discussion forums, to identify common issues or concerns, and to allow faculty and staff to address them in a timely manner. This system could conduct sentiment analysis on student feedback, providing a more nuanced and comprehensive understanding of student experiences. This AI-powered tool could analyze text from various sources, such as course evaluations, discussion forums, and email communications, to detect positive, negative, and neutral sentiments, as well as more specific emotions such as frustration, satisfaction, confusion, or excitement. These analyses could provide insights into how students feel about their courses, the teaching methods, course materials, and the overall learning experience. Once again, implementing sentiment analysis would come with its own challenges; chief among them ensuring the accuracy of the AI's sentiment analysis. This would require human reviewers to validate the AI's analysis, at least initially. Over time, as the AI learns and improves, it could become more accurate in its sentiment detection and help faculty better understand how to serve their students. Another challenge would be ensuring the privacy and security of student feedback. Institutions would need to implement robust data protection measures and ensure the AI is only accessing and using feedback data in a way that complies with all relevant privacy laws and regulations. Despite these challenges, the potential benefits of sentiment analysis and VTAs are significant. By providing a more nuanced, comprehensive understanding of student needs and having timely responses to them, AI could help an institution enhance its courses, teaching methods, and overall learning experience. This could lead to improved student satisfaction and academic outcomes.

Community Building and Engagement

As the enhanced early warning system catches students who are at risk much earlier and students receive the type of teaching and learning environments they need to be successful, AI-driven social network analysis could also be leveraged to identify and foster connections among students, faculty, and alumi. This could help build a strong community and improve overall student satisfaction.

At present, community building and engagement at many institutions can be fragmented and conceptualized from a campus-based mindset. It is a challenge to create a sense of community that transcends physical boundaries and time constraints, particularly in an online learning environment. to this end, AI could be pivotal in fostering a vibrant, connected, and engaged university community. An AI system could analyze data from various sources—such as social media, discussion forums, and event attendance records—to understand the interests, needs, and behaviors of the community members. It could even predict them, similar to how social media platforms and streaming services do (i.e., "you might like"). The AI could use this information to facilitate community building and engagement in several ways, such as:

- personalized event recommendations: recommending events to students, faculty, and staff based on their interests, academic focus, and previous event attendance. This could increase event participation and help individuals find the most relevant and engaging events.
- virtual community spaces: facilitating the creation of virtual community spaces based on shared interests or academic focus. These spaces could provide a platform for discussion, collaboration, and connection, fostering a sense of community among members.
- community engagement analytics: analyzing engagement data to identify trends, such as popular discussion topics or highly attended events. This could provide insights to help the university enhance its community-building efforts.
- proactive engagement: proactively reaching out to individuals who may be less engaged, suggesting events or community spaces they might be interested in. This could help ensure all community members feel included and engaged.

To implement this vision, institutions need to integrate AI into its existing systems and data sources, then train it to interpret and analyze data related to community engagement and make recommendations based on this data. It would be critical to ensure the privacy and security of community members' data by creating robust data protection measures and ensuring the AI's use of data complies with all relevant privacy laws and regulations. It would also be important to ensure the AI's recommendations are relevant and beneficial to community members by regularly reviewing and refining the AI's recommendation algorithms based on feedback from the community. Despite these challenges, AI offers significant potential benefits creating a more connected, engaged, and vibrant community, which would enhance the university experience for all members.

Inexhaustible Tutoring Systems

Logically aligned with the previous scenarios, AI-powered tutoring systems that adapt to each student's needs and provide personalized guidance and support in real time would be another excellent future use of AI. Currently, tutoring is most often provided through in-house tutors or outsourced to private companies. While these tutoring models provide valuable support to students, these services may not be available on demand or at all hours, which could limit their effectiveness. Human tutors can become fatigued and perhaps move from tutoring to doing the work for the student.

An intelligent, inexhaustible tutoring system could be available 24/7 for ondemand, interminable assistance. Inspired by systems like Khan Academy's (n.d.) Khanmigo, this AI-powered tutor could provide students with immediate, personalized academic support. It could help students with various academic needs, from understanding complex concepts to providing feedback on assignments. It could adapt its teaching strategies based on each student's learning style and progress, providing a highly personalized learning experience. For example, if a student struggles with a concept, the system could provide additional explanations, examples, and practice problems. If a student makes a mistake, it could provide immediate feedback and suggest strategies for avoiding similar mistakes. in addition to integrating this type of AI into the existing systems at an institution, it would need to be trained using a combination of academic content from existing courses and data on effective tutoring strategies. Over time, as the AI interacts with students, it could learn and improve, becoming an increasingly effective tutor. of course, this type of system would come with some potential downsides, chief among them ensuring the accuracy and effectiveness of its tutoring and student assistance. This could be addressed by having human tutors review and approve the first few sets of responses; over time, as it learns and improves, it could become more autonomous. Moreover, security and privacy data must be addressed just like in the other scenarios of integrating AI into existing university systems. Even with downsides and the need to protect student data, providing on-demand, personalized, and inexhaustible tutoring could enhance student learning, improve academic outcomes, and contribute to a more equitable learning experience for all students.

AI-Driven Career Support

With the end in mind, AI tools could be used in a university setting to analyze students' skills, interests, previous work experiences, and academic performance; suggest suitable career paths and job opportunities; and recommend courses to help them achieve their career goals. At present, most universities have a dedicated team of career advisors who assist students with career skills, internship placements, and job opportunities. Some institutions may even have career-focused courses in the curriculum at key points in a student's academic journey. While these resources provide valuable support to students, there may be opportunities to enhance this support by using AI for more personalization and predictive features.

An AI-driven career support system could complement the work of existing career advisors and enhance existing career-focused curricula. This AI-powered tool could provide a range of services to both students and the career department, including:

- career exploration: helping students explore potential career paths based on their interests, skills, previous work experiences, and academic focus and providing information on various careers, including job descriptions, required skills, and potential salary ranges.
- personalized career advice: providing personalized career advice based on each student's profile. For example, it could suggest specific internships, job opportunities, or additional courses that align with the student's career goals.
- resume and cover letter assistance: providing feedback on students' resumes and cover letters and suggesting improvements based on best practices, exemplars of those working in the intended career, and the specific requirements of each job application
- interview preparation: helping students prepare for job interviews by providing common interview questions, suggesting responses, and offering feedback on their answers through a simulated and responsive two-way dialog.
- career trend analysis: analyzing job market trends to identify growing industries, in-demand skills, and emerging job roles. This information could help students make informed decisions about their career paths and help the career department tailor their services to meet changing needs.

Similar to other scenarios discussed in this section, AI would need to be integrated into the existing environment and the student data would need to be secured. Then, the AI would need to be trained using a combination of careerrelated data from the institution's alumi population, job market trends, and data on effective career advising strategies. Over time, as the AI interacts with students and the career department, it could become an increasingly effective career support tool. Like other applications discussed, it would be important to have human supervision as the tool is being implemented to ensure accuracy, but it could become more autonomous over time. Providing personalized, ondemand career support could be a critical way to improve career outcomes for students and contribute to more holistic and supportive learning and better future earning potential.

Intelligent Course Development

While most scenarios generated through scenario building and future mapping yielded results related to teaching and learning within the learning analytics framework at National Louis University, one scenario emerged that could significantly impact student learning: intelligent course development. Employing AI algorithms to analyze course content, previous student learning patterns, grade data, etc. and then recommend improvements, updates, or additional resources based on these data could lead to more engaging and effective course materials and course designs that lead to deeper student learning.

At present, developing courses at most universities can be a labor-intensive process that is heavily reliant on instructional designers and faculty members. This process typically involves subject matter research, content creation, and course design, all of which require significant human time and effort. While this approach ensures a high level of expertise and quality, it may limit the speed of course development and the diversity of perspectives included in the course content. A future exists, however, when AI is not just an assistant in student learning and teaching but also an integral part of the course development team. AI could dive into the depths of the internet, academic databases, and even social media trends to bring together the most relevant, up-to-date, and diverse resources for course development. The AI could serve as a digital co-professor and subject-matter expert, working alongside the instructional designer and faculty member. It could scan the latest research papers, articles, and online content related to the course subject, ensuring that the course content is cutting edge and reflects the latest developments and trends in the field. It could also analyze student feedback and performance (learning) data from previous course offerings, identifying patterns and trends that humans might miss. It could then suggest improvements or updates based on this analysis, essentially learning from each cohort of students how to make the course better for the next one.

Moreover, AI could help ensure multiple perspectives are represented in the course content and learning design. It could suggest resources from diverse authors and sources, promoting inclusivity and diversity in the learning material without being influenced by common biases that humans often unconsciously develop over time. It could even identify gaps in the current content, such as underrepresented perspectives or overlooked topics, and suggest ways to fill these gaps. Course development could be a dynamic, iterative process, constantly evolving and improving with each cohort of students. The AI would not only accelerate this process but also enhance the quality, diversity, and

relevance of the course content, thereby creating a richer and more engaging learning experience for students.

Like previous scenarios, integration challenges and privacy issues would need to be addressed. in addition, the biases that could emerge based on the information the AI has access to would need to be managed. It would also need to be tuned to the subject matter, level of the course, needs of the students, and quality standards. All these potential downsides could be mitigated by ensuring the instructional design team or the faculty member carefully review AI recommendations to ensure alignment and relevancy. Despite these challenges, the potential benefits of intelligent course development are significant. It cannot be overlooked as a critical enabler of quality teaching and learning that underpins the other scenarios developed during this process. By leveraging AI, the university could accelerate course development, enhance the quality and diversity of course content, and ensure its courses reflect the latest advances in each subject. This could revolutionize the course development process and improve student learning experiences.

Key Items For Consideration

The power of artificial intelligence lies in its ability to process vast amounts of information quickly and efficiently, enabling institutional leaders to extract valuable insights and make data-driven decisions. It has the power to automatically analyze complex datasets, identify patterns, and uncover hidden relationships. By harnessing the computational power of AI, institutions can gain a competitive advantage by unlocking actionable intelligence from their data.

The promise of AI holds even for colleges and universities that have already created disciplined data structures and operations. AI can enhance an institution's capacity for data-driven decision making by leveraging advanced algorithms and machine learning. AI systems can analyze and interpret data with exceptional speed and accuracy, empowering decisionmakers to make better informed choices and then to better serve their students, faculty, and staff. These AI-powered tools can identify patterns, trends, and correlations that might have gone unnoticed with exclusively human-based analyses, offering a deeper understanding of past performance and future possibilities. With the ability to process massive volumes of data in real time, AI can enhance decision making by reducing human bias, providing predictive analytics, and optimizing resource allocation. AI could unlock the full potential of an institution's data, resulting in more effective and efficient use of resources to drive student success and innovation.

AI's Strength in Planning for the Future

Using AI for future mapping and scenario planning involves leveraging the power of artificial intelligence to analyze large amounts of data and simulate

possible future scenarios. Some of the strengths of using AI in this way include:

- data collection: gathering relevant data from various sources, such as historical data, real-time data feeds, surveys, and social media
- machine learning and predictive modeling: Using machine learning, predictive models can be developed using the collected data. These models can identify patterns, correlations, and trends, enabling predictions and projections to create multiple future possibilities.
- scenario generation and simulation: AI algorithms can generate and simulate multiple future scenarios based on the trained models.
- decision-making support: Working in conjunction with human analysts, AI can assist with decision making and planning processes. It can also provide valuable recommendations, identify risks, and help prioritize actions based on the projected outcomes of different scenarios.
- iterative refinement: AI can continually refine and enhance future mapping and scenario planning by incorporating new data and feedback. This iterative process may improve the accuracy and reliability of future predictions and scenario planning.

AI Limitations

While AI brings immense power to data and learning analytics, it also has certain limitations that higher education leaders must consider. Chief among those limitations are:

- Data bias. AI systems trained on historical data that an institution has generated poses the risk of inheriting biases present in that data. If the data used to train AI systems already reflect systemic biases, these biases can then be perpetuated in learning analytics. For example, if past educational practices disadvantaged certain groups, AI might reinforce these disadvantages by recommending similar interventions. Additionally, data that are more representative of majority groups (e.g., racial, ethnic, cultural) may only yield results favorable to the majority group, further widening equity gaps.
- Unequal distribution of resources. Institutions with more financial and human resources can afford better AI tools and infrastructure, giving their students an advantage over those attending underfunded institutions such as community colleges or smaller liberal arts colleges versus larger public research institutions.
- Privacy. As mentioned in each scenario, the collection and analyses of vast amounts of student data can raise privacy concerns, particularly those students who might be more vulnerable to data breaches or misuse of their personal information over others.
- Algorithmic opaqueness. The opacity of many AI algorithms can make it difficult for educators and students to understand how decisions are being made

with any type of fidelity. Deep learning algorithms, for instance, can produce highly accurate results, but interpreting how the conclusions are generated can be challenging. This lack of transparency can hinder trust and understanding, particularly when explanations and justifications for analytical outcomes are crucial or conclusions are counterintuitive to expected outcomes. Furthermore, this lack of transparency can reduce reliance on the information being produced thereby compromising the potential gains from it.

• Ethical issues. AI-driven decision-making in education can raise ethical questions, particularly when it comes to determining who has the authority to set algorithms and make decisions about students' educational paths. AI algorithms are only as good as the data they are trained on and it is incapable of ethical considerations in producing results. Ensuring fairness, transparency, and ethical considerations in AI-driven data analytics is a complex challenge that requires ongoing monitoring, evaluation, and mitigation strategies

Practical Considerations

In addition to a multitude of ethical considerations surrounding the use of AI, various legal and practical issues also pervade this technological landscape. These concerns range from minor to significantly impactful. A salient issue involves deciphering what AI usage implies for ownership and intellectual property. As individuals create processes and systems to address challenges, determining who maintains the right to utilize and commercialize solutions crafted with openly accessible AI becomes a pertinent question. Similarly, since AI systems are commonly trained using existing data, they may generate content that infringes upon pre-existing intellectual property rights, thereby instigating legal disputes.

Moreover, AI is not immune to critical errors. When unmonitored, it may generate or amplify misinformation or manipulative content, adversely affecting decision-making processes. As these issues emerge, determining liability when AI systems cause harm or make erroneous decisions proves to be intricate. Who should be held accountable - the developer, the user, or the machine itself? Without adequate oversight, AI systems might unintentionally breach laws and regulations, resulting in legal repercussions and tarnishing the reputations of affiliated organizations.

Furthermore, as AI processes expand to handle more data, ensuring the security of this data is crucial. Large data repositories might not only become targets for cyber-attacks and security breaches but also need to be safeguarded against potential internal misuse or malicious manipulation. Ultimately, utilizing AI without appropriate oversight may infringe on privacy rights and civil liberties. Liability also emerges as a significant concern. Existing laws may need adaptations to manage the risks associated with autonomous systems, robots, and other AI-driven products and services.
AI Weaknesses in Planning

Just as AI is effective in helping institutional leaders prepare for the future, there are also clear limitations that must be considered when using AI for future mapping and scenario planning. Key to all of these limitations is the need for human analysts to closely monitor the data being produced by AI. Some critical limitations include:

- data limitations: AI heavily relies on data availability and quality. Incomplete, biased, or insufficient data can lead to inaccurate predictions and flawed scenario planning.
- uncertainty and unpredictability: Future events and circumstances can be highly uncertain and unpredictable. AI models may need help to account for unforeseen factors, sudden disruptions, or rare events that fall outside the scope of historical data.
- assumption-based modeling: AI models are based on assumptions and simplifications. These assumptions might not fully capture the complexity and nuances of real-world scenarios, leading to limitations in accuracy and applicability.

Too, AI-based scenario planning requires careful consideration of ethical implications mentioned above, most importantly biases in data or models that perpetuate inequalities or favor certain groups while excluding others, and decisions based solely on AI predictions that may neglect human values, subjective judgments, key laws or regulations, and pertinent social dynamics. For an institution like National Louis University that has at its core the tenets of access and innovation, these concerns requiresextreme vigilance to ensure the institution does not allow technological innovation to make decisions that harm the students the institution serves.

Perhaps the most crucial element in utilizing AI in general, and for future planning in particular, is the critical nature of human interaction for both the technical nature of integration and supervising the outputs. While AI excels at data analysis and pattern recognition, it lacks the human intuition and creative problem-solving skills needed for nuanced scenario planning. Human expertise, insights, and humanity remain crucial in interpreting and contextualizing AI-generated results. Strong human engagement allows for an iterative process to generate positive results and allow an institution to look forward to implementing new business processes and innovation.

Conclusions

Through the use of AI-enabled scenario building and future mapping, NLU was able to identify ways to improve its existing learning analytics framework. While the current system has proven very effective at helping identify students' needs and highlighting where human intervention might be required, taking the time to build new scenarios and map different futures to continue

improving the institution was an essential next step. Those new AI-generated scenarios have the potential to unlock opportunities that will allow the institution, and others, to begin planning for the future as AI continues to mature and evolve. Moreover, this effort amplified the underlying feelings of the team that more can be done to support learners in their academic journey through a more robust and accurate learning analytics framework that could underpin new or enhanced (a) personalized learning paths, (b) virtual teaching assistants, (c) community building and engagement, (d) inexhaustible tutoring, (e) career support, and (f) intelligent course development.

Despite the considerable barriers related to the technical acumen needed to integrate AI and the need for humans to supervise the output, for a short time or perhaps forever, the promise of using AI to bolster the very heart of teaching and learning at an institution of higher education cannot be overlooked or disregarded. As institutions continue to operate in an increasingly competitive environment amid shrinking demand and commoditization, they face the challenge of finding ways to better support their students. One potential solution is the integration of AI into existing student support and teaching and learning systems. By leveraging AI technology, these institutions have the opportunity to create a virtuous cycle. They can build a strong reputation for good student outcomes, which fosters a quality culture that prospective students will actively seek.

The integration of AI can also strengthen academic progression. For example, at an institution that has proven itself to be laser focused on student success through the use of learning analytics and AI integration, even nondegree-seeking students could progress through doctoral-level studies more efficiently and cost-effectively. This level of support and innovation opens up new possibilities for students to achieve their educational goals, regardless of their starting point. Further, institutions under extreme pressure to cut costs and keep quality high could turn to technology, such as AI, to resolve this paradox.

The tide of technological innovation will continue to flow, and AI may catalyze an even faster adoption cycle. Universities and colleges that fail to recognize and embrace this type of change environment could be quickly left behind as students become increasingly discerning and the economy looks for more skilled employees upon graduation. Institutional leaders can, even today, capitalize on the availability of AI and use AI platforms such as ChatGPT to build scenarios and perform future mapping to explore opportunities to create learning analytics environments or improve their existing ones.

References

- Caspari-Sadeghi, S. (2023) Learning assessment in the age of big data: Learning analytics in higher education. Cogent Education, 10, 1. https://doi.org/10.1080/2331186X.2022.2162697
- Dickler, R. (2021, November 8). How is the field of artificial intelligence shaping educational contexts? Let's explore both the benefits and challenges of innovative AI-driven analytics. Society for Learning Analytics Research. https://www.solaresearch.org/2021/11/learning-with-and-fromartificial-intelligence-driven-analytics/
- Firat, M. (2016). Determining the effects of LMS learning behaviors on academic achievement in a learning analytic perspective. Journal of Information Technology Education: Research, 15, 75–87.
- Gašević, D., Dawson, S., & Siemens, G. (2014). Let's not forget: Learning analytics are about learning. TechTrends, 59(1), 64–71. https://doi.org/10.1007/s11528-014-0822-x
- Khan Academy. (n.d.). Khan Academy. https://www.khanacademy.org/khan-labs
- Knight, S., Buckingham Shum, S., & Littleton, K. (2014). Epistemology, pedagogy, assessment: Where learning meets analytics in the middle space. Journal of Learning Analytics, 1(2), 23–47. https://doi.org/10.18608/jla.2014.12.3
- Long, P., & Siemens, L. (2011). Penetrating the fog: Analytics in learning and education. EDUCAUSE Review. https://er.educause.edu/articles/2011/9/penetrating-the-fog-analytics-in-learningand-education
- Macfadyen, L., & Dawson, S. (2012). Numbers are not enough. Why e-learning analytics failed to inform an institutional strategic plan. Educational Technology and Society, 15, 146--163.
- McCarthy, J., (n.d.). What is AI? http://jmc.stanford.edu/artificial-intelligence/what-is-ai/index.html
- McKinsey & Company, (2022, December 6). The state of AI in 2022—and a half decade in review. https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2022and-a-half-decade-in-review
- Nguyen, Q., Tempelaar, D., Rienties, B., & Giesbers, B. (2016). What learning analytics based prediction models tell us about feedback preferences of students. Quarterly Review of Distance Education, 17(3), 13–33.
- Phillips, B. (1996, April 1). Future- mapping: A practical way to map out the future and achieve what you want. Career Development International. https://doi.org/10.1108/13620439610114298/full/html
- Rhisiart, M., Miller, R., & Brooks, S. (2015). Learning to use the future: Developing foresight capabilities through scenario processes. Technological Forecasting and Social Change, 101, 124–133. https://doi.org/10.1016/j.techfore.2014.10.015
- Salas-Pilco, S., Xiao, K., & Hu, X. (2022). Artificial intelligence and learning analytics in teacher education: A systematic review. Education Sciences, 12, 569. https://doi.org/10.3390/educsci12080569
- Siemens, G. (2011) Learning and Academic Analytics. Learning Analytics. https://www.learninganalytics.net/?p=131
- Ziede, E. (2019, August 26). Artificial intelligence in higher education: Applications, promise and perils, and ethical questions. EDUCAUSE Review. https://er.educause.edu/articles/2019/8/artificialintelligence-in-higher-education-applications-promise-and-perils-and-ethical-questions

THE POTENTIAL OF EDUCATIONAL CHATBOTS FOR THE SUPPORT AND FORMATIVE ASSESSMENT OF STUDENTS

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Introduction

Higher education faces a number of challenges today. One of these is the diversity of students and the growth of enrollment in online programs. The direct personal relationship with students has been reduced and this, combined with larger ratios, makes it difficult to provide the personalized follow-up that students need. in this context, artificial intelligence comes in as a valuable technological support.

Over the last decades, different types of chatbots have been used in the field of education under different names, such as agents, virtual characters, intelligent agents, conversational bots, cognitive assistants, pedagogical agents, "guidebots" or avatars (Vijayakumar et al., 2019; Trust et al., 2023; Okonkwo & Ade-Ibijola, 2020). Chatbots are conversational or interactive agents that provide instant responses to the user using natural language in the form of text messages (websites or mobile applications), voice-based (Alexa or Siri), or a combination of both (Kumar, 2021). They make it possible to maintain a dialogue between a human and a computer (Dimitriadis, 2020), according to the information contained in a database and in an artificial intelligence module. These chatbots are programmed using a variety of technologies, such as programming languages and databases. They can use artificial intelligence and machine learning to improve their ability to understand natural language and adapt to users' needs and preferences (Wang et al., 2018).

Kuhail et al., (2023) analyzed 36 educational chatbots and found that they were used in a variety of fields, including mainly computer science, language, general education, engineering, and mathematics. Most of them were accessible through a web platform, and only a few could be used on mobile and desktop platforms. Kumar (2021) reported numerous benefits of chatbots as an instructional tool for higher education: improving of learning confidence, motivation, self-efficacy, learner control, engagement, knowledge retention and access to information. They can also increase the efficiency and effectiveness of communication and provide a more personalized and satisfying experience for users (Li et al., 2016).

Chatbots can be used in different ways: as a source of information and reflection (Wellnhammer et al., 2020); to answer questions, give advice, and perform a variety of automated tasks, facilitating a dynamic and autonomous learning experience (Zhou et al., 2017; Clarizia et. al; 2018; Merelo et al., 2023). They are also useful for understanding assessment criteria, and for learning, assessing, and tracking learning, as they can provide immediate and personalized feedback to students (Liu et al., 2018). The use of chatbots can be particularly interesting in online classes, where there is a high student to teacher ratio.

Okonkwo & Ade-Ibijol (2021) note that chatbot systems are mainly used in educational contexts for teaching and learning, administration, assessment, and research and development. The results of their systematic review show that teaching and learning aspects receive more attention from scholars than other areas (p.8). Educational chatbots can also be used to solve administrative problems and provide support for students (Martins, 2023; Pérez et al., 2020), such as providing notifications, reminders, alerts, and data management support (Kumar, 2021).

Some universities have already implemented service-oriented chatbots to reduce the workload of administrative staff and be able to respond quickly to the student queries (e.g., admissions and enrollment process, university life, library services, etc.). For example, chatbots have been used to provide help and support to students in online courses, including answering frequently asked questions and providing guidance on the course (Shah & Rehman, 2018).

Despite the growing adoption of chatbots in higher education, research in this area is still relatively new (Studente, 2022), and has focused on language learning, economics, medical education, and programming courses (Winkler & Söllner, 2018). As can be seen in figure 1, in 2022 there was a notable increase in the number of publications on the use of chatbots in higher education in the Scopus and Web of Science databases compared to the previous year. This increase may be related to the possibility of implementing chatbots in the classroom without the need for programming skills (Wong, 2022).

At the time of conducting the search (October 17, 2023), the total number of publications for the year 2023 could not yet be registered, but an increasing trend can be observed from the year 2021 onwards. The search query was the following: TITLE-ABS-KEY (chatbot* AND higher education* AND learning*) AND PUBYEAR > 2019 AND PUBYEAR < 2024.



Figure 1. Evolution in the number of documents published (January 2019-October 2023).

China, USA, and UK have generated the most publications on the use of chatbots in higher education. Figure 2 shows countries with at least five documents collected in each database.



Figure 2. Number of documents by country (January 2019- October 2023).

A growing body of research has explored the potential impact of chatbots in education. Wang et al., (2021) suggest that future research should focus on the added value of chatbots and compare the differences between chatbot learning and other traditional learning methods. Kuhail et al., (2023) points out the need for a systematic literature review on the following key aspects:

Application area, platform, role in education, interaction style, design principles, empirical evidence, and limitations. Wong (2022) notes that no acceptance models have been used to explain the acceptance of chatbots by students.

In this chapter, we will discuss the extent to which chatbots can improve learning efficiency and increase knowledge retention in higher education, based on various research studies. Another interesting question is how chatbots can support higher education students and faculty in the teaching and learning process. How can these tools facilitate communication and collaboration between students and faculty? What are the limitations of these tools to foster deep learning? The opportunities and risks of chatbots will be analyzed as a guide to help faculty to think critically about the impact this tool could have on higher education. Examples of chatbots developed and implemented at seven universities are also included, along with the methodology and results obtained. Finally, we offer a set of recommendations to introduce chatbots in higher education courses.

Research on the potential of chatbots to improve learning efficiency and increase knowledge retention

In recent decades, scientists and researchers have been trying to design AI tools to automate different aspects of teaching and learning from intelligent tutoring systems (ITS) to learning analytics, (Trust et al., 2023). The ITS emerged as an ambitious proposal for the individualization of teaching through the application of artificial Intelligence (AI). These systems were based on the contributions of the cognitive psychology of information processing, attempting to transfer the cognitive processes of human action in decision making to digital machines.

The goal of the ITS was to exhibit a behavior similar to that of a human tutor and to adapt to the student's needs. to do this, the system identified how the learner solved a problem to provide help when the learner made mistakes. The ITS also identified the knowledge the learner needed to solve a problem and explained that knowledge at the appropriate time (González, 2004). Research conducted in the late 1980s already showed the positive effect of ITS on student performance (reducing the time needed to complete a task) and motivation. It also reduced the workload of the teacher, who could focus on the specific difficulties of the students (Anderson et al., 1995).

The instructional design of ITS was strongly influenced by Gagne's theory, which implies knowledge of the phases of learning and task analysis. Thus, to achieve certain learning outcomes, it is necessary to know the internal conditions that will intervene in the process and to try to make the external conditions as favorable as possible to the learning situation (Castejón, 1997). The main problem with ITS has been sufficiently adapted to the previous

knowledge and development capacity of each student (Redondo-Duarte, 2012).

Over the past decade, conversational agents have attempted to overcome the problems of ITS and have been developed to perform a variety of pedagogical roles, such as tutors, coaches, and learning companions. Among the primary benefits of chatbots applications for the learning process, Okonkwo & Ade-Ibijol (2021) identified the following: content integration, rapid access, motivation and engagement, multiple users, and immediate assistance. Chatbots are being used to answer frequently asked questions (FAQs), provide short quizzes, scaffolding, activity recommendations, and information about activities (Kuhail et al., 2023).

Various Studies have demonstrated that the consistent, personalized practice that chatbots provide to learners improves learning effectiveness and increases knowledge retention (Nourbakhsh and Yaser, 2017). This potential to improve learning outcomes is due to their ability to personalize the learning experience (Wang et al., 2021; Winkler & Söllner, 2018).

Wu & You (2023) conducted a meta-analysis of 24 randomized trials to examine the impact of chatbots on student learning outcomes. They concluded that chatbots had a large effect on students' learning outcomes. This effect was larger for students in higher education, compared to students in primary education and secondary education. The findings of Khidir et al (2022) indicate that e-learning tools such as chatbots are effective learning tools for students learning complex software. They found that e-learning students were highly satisfied with chatbots and became confident in using them. Similarly, Wong (2022) conducted a pilot study in which the students compared a chatbot and a quiz website. He found that over 80% of the students agreed that the chatbot was better than the quiz website in many ways.

In foreign language education, chatbots have been used to provide conversational practice due to their ability to simulate a conversation with a native speaker (Shah & Rehman, 2018). Chen et al., (2020) investigated the impact of using a newly developed chatbot to learn Chinese vocabulary by comparing how it worked in different learning environments. The results showed that the chatbot significantly improved students' learning outcomes and that a one-toone environment can lead to better results than what could be achieved in a classroom. Chatbots enrich language input and provide opportunities for language learners to improve their communication skills (Kim et al., 2019).

Wu & You (2023) suggest that novelty effects of chatbots could improve learning outcomes in short interventions. Fryer et al., (2017) also found that students' interest in communicating with the chatbot decreased significantly between the first and the second tasks in a longitudinal study. This decrease did not occur when students interacted with a peer. An interesting aspect at this point may be the autonomy that the learner has in directing the conversation with the chatbot. in their systematic analysis, Kuhail et al., (2023) found that most of the articles (88.88%) used the chatbot-driven interaction style, where the chatbot controls the conversation. Only 11.11% of the articles used chatbots that engage in user-driven conversations where the user controls the conversation.

Some research has focused on the potential of chatbots to develop crosscurricular competencies in students. Chatbots have been shown to have some positive effects on students' communication skills through negotiation of meaning and the increased interactions and interest in learning (Kim et al., 2019). Kumar (2021) also found positive effects on the perception of teamwork, moving from simply learning new ideas, communicating, and accepting opinions to the need to cooperate as a team to achieve the project goal. Chatbots can also play a major role in management education to make judgments and decisions, give and receive feedback, and develop analytical thinking and technological awareness (Winkler & Söllner, 2018).

Although current chatbots seem to have overcome the problems of ITS, they still face significant challenges. For example, they need to be able to generate different representations of each learning object according to the cognitive needs of the learner. Piaget's studies showed that knowledge is an authentic process of personal construction because of the interaction of the subject with the environment. Nowadays, a large part of our students' environment is technology, including chatbots such as Chat GPT. Following the constructivist approach, the learner should be able to use the chatbot to explore, articulate what he or she has learned, and speculate (conjecture, hypothesize, contrast), manipulate the environment (elaborate a product, manipulate parameters, make decisions) to develop and test their theories and models (Johanssen, 2000).

In this regard, it is worth noting the difference established by Neumann et al (2021) with respect to the typology of chatbots, splitting them in task-oriented and non-task-oriented. The tasks-oriented bots are created to help the user solve a specific task, while non-task-oriented ones are intended to generate a conversation, without having a specific task in mind to be addressed during the conversation (p. 2). So how can chatbots be integrated into the learning process to foster cognitive conflict and help learners think? Kuhail (2023) reported cases in which the chatbot guides the learner to choose the topic to learn and asks questions to help the student reflect and construct their knowledge. The level of the assessment becomes more challenging as the student progresses. Newman et al (op. Cit) developed FeedBot, a chatbot that supports students in their self-study, offering writing tasks on the literature and providing automatically generated feedback in the form of graphs (p.3).

Thus, educational chatbots have an undeniable potential to foster the personalization of learning and to develop cross-curricular competencies, such as communication and teamwork. They are particularly useful for achieving learning outcomes in areas such as language learning or computing. in addition, they are proved to be valuable tools to help in self-study and to monitor their own learning progress. However, more research is needed to investigate the mechanisms underlying the effects of chatbots on students' learning outcomes (Wu & You, 2023). in addition, research on learning outcomes has not been conducted across different educational domains and levels of education (Kumar, 2021).

Possibilities of chatbots to guide and support the teaching and learning process

Chatbots can act as facilitators (Martins, 2023) and classroom assistants to generate knowledge, increase student engagement, and provide intelligent feedback (Pérez et al., 2020; Martins, 2023). For example, a chatbot can interact with students through a chat interface and provide additional explanations and examples on difficult concepts, as well as feedback and tips to improve performance. They can engage students with small talk, showing interest and social presence (Kuhail, 2023).

Chatbots can incorporate social dialogue to engage the students, build relationships with users and gain their trust. Affective interactions such as greetings, humor, emoticons, and/or empathy should also be included to improve emotional engagement (Kumar et al., 2021). Kuhail et al., (2023) reported a case where the chatbot allowed students to tell jokes, fun facts, or talk about the weather to take a break. Similarly, educational chatbots can create a relaxed self-learning environment for students who feel shy and anxious about making mistakes in front of peers and teachers (Wu & You, 2023) and could be a useful technology to solve the lack of personalized attention, improving satisfaction and decreasing the attrition rate (Winkler & Söllner, 2018).

It is interesting to reflect on the teaching and learning approach that chatbots promote, depending on their educational purpose. in this sense, chatbots can act either as tutors that scaffold the learning process, or as training and practice programs for skill acquisition. in the first case chatbot can adapt, select, and sequence content according to the needs and pace of the learner, facilitate reflection and metacognition processes, and motivate learning. The instructional design under this type of chatbot corresponds to a socio constructivist approach, as it encourages dialogue, reflection, and collaboration. in the second case (training and practice programs) we would be closer to behavioral and cognitivist approaches, where the chatbot presents a stimulus in the form of a question or problem, to which the student must respond (Brustenga et al., 2018). Several studies demonstrated the positive influence of chatbots on learning motivation (Wu & You, 2023; Kim et al., 2019; Yin et al., 2021). Vijayakumar, Höhn & Schommer (2018) deployed on Facebook Messenger a chatbot called SQL Quizbot. The results revealed that more than 80% of users found immediate feedback useful. Other instant messaging platforms (Telegram or WeChat) have been used to encourage students' interactions (Essel et.al; 2022). Chatbots also contribute to students' self-regulation during the learning process (Uceda et al., 2023, Rejón-Guardia & Vich-i-Martorell, 2023). A chatbot can answer and pose questions to a large number of students, guide them and help solve problems. This means that the student could make progress, even when the teacher is not available, so that he/she does not feel alone in the learning process.

Chatbots also have great potential as an aiding tool for e-learning systems to increase user motivation, a key variable to success in the learning process. Specifically, in an online program, the absence of feedback and the fact of feeling excluded or disconnected from the group can cause the student's demotivation and dropout from the program (Redondo-Duarte, 2012). Wu et al (2022) concluded that chatbots could be helpful in learning and could potentially reduce e-learning users' feelings of isolation and detachment.

Chatbots can provide support and guidance to students during the teaching and learning process, which can significantly improve their performance and motivation (Gan et al., 2017; Mohan, 2018). They may play different roles to guide and support students in their learning process:

- Teaching assistants: chatbots can recommend tutorials based upon learning styles; start a conversation by asking the students to watch educational videos followed by a discussion about them, or to present scenarios to be discussed with students (Kuhail et al., 2023). There is a considerable increase in the number of chatbots whose purpose is teaching, that is, to generate knowledge on a specific topic (Pérez, Daradoumis & Puig, 2020). They have also been used in other areas of education, such as teaching problem-solving skills and decision making in learning (e.g., Jill Watson AI platform, created using IBM Watson technology). Some chatbots are also able to simulate specific professional situations and can support reflection or therapy (Brustenga et al., 2018).
- Peer agents: chatbots allow students to ask for specific terms or concepts, questions, and answers (Q&A), how to use a particular technology, or scaffold a group discussion (Kuhail et al., 2023). Scaffolding was used as a learning strategy in a chatbot named Sara to improve students' learning (Winkler et al., 2020). The chatbot provided voice and text-based scaffolds when needed. The approach had a significant improvement during learning programming tasks.
- Motivational agents: chatbots can ask questions, and then react to the answer with varying emotions, including empathy and approval, to motivate students with encouraging phrases. They can also foster affective learning in the form of

sympathetic and reassuring feedback to support learners in problematic situations.

• Tutoring systems: some chatbots are used such as virtual teachers or tutors to guide and instruct students (e.g., AutoTutor). They incorporate strategies from human tutors and use voice and visual representation (3D character) to create the feeling that a real tutor or teacher is learning alongside students. Other chatbots (e.g., Deakin Genie, created by Deaking University) can help students to organize their study, for example creating schedules, setting reminders, etc. (Wu et al., 2020).



Figure 3. Roles of chatbots in education. Source: own elaboration.

The use of chatbot relieves the faculty and frees up time to focus on planning and executing activities that contribute in a richer and more varied way to their students' learning (Rejón Guardia & Vich i Martorell, 2023). Thus, chatbots can support faculty in writing course syllabi, lesson plans, classroom rules and policies, learning objectives, directions for learning activities, discussion prompts, plans for substitute teachers, mini-lecture presentation scripts, and tips for classroom management (Rust, Whalen and Mouza, 2023). Kuhail et al., (2023) mentioned a conversational agent named MentorChat, a cloudbased Computer Supported Collaborative Learning, to help teachers build dialog-based collaborative activities.

It is essential to involve students in the design and development of these tools to ensure they meet the students' needs, expectations, and motivations (Rejón Guardia & Vich i Martorell, 2023). An important aspect prior to the implementation of a chatbot is the process of co-creation and co-design with its future users (Durall et al., 2022). This could be carried out through workshops with stakeholders where they are asked about their needs and expectations with the chatbot.

Formative feedback and assessment using chatbots

The implementation of chatbot in higher education is a promising opportunity for the improvement of communication and the overall experience of students in the teaching and learning process (Sandoval, 2018). Current research highlights that chatbots may address the challenge of insufficient studentinstructor interaction (Clarizia et al., 2018). Feedback helps students regulate their learning. Villegas et al., (2020) noted that the lack of assessments and exercises, along with the absence of a feedback mechanism, negatively affected the success of the chatbot.

Thus, the chatbot should establish a relationship between learner-learner and learner-instructor through activities that enable them to relate, share information, communicate, and/or collaborate (Kumar et al., 2021). Chatbot interaction is achieved by applying text, speech, graphics, haptics, gestures, and other modes of communication to assist learners in performing educational tasks (Kuhail et al., 2023: 974). Chatbot should also incorporate active learning and communication strategies that allow the instructor to monitor learning progress (Kumar, 2021).

Combining chatbots with a computer-assisted assessment is useful to provide students with meaningful feedback and motivates engagement. Kuhail (2023) reported on a study in which the chatbot (used to learn a foreign language) assessed the quality of the transcribed text and provided constructive feedback. Tools like Chat GPT can provide support with student assessment, such as writing progress reports, quizzes and test questions, and rubrics for grading. They can also provide automatic grading and feedback to students, as well as constructive suggestions for improving writing and speaking (Trust et al., 2023).

A very interesting application of chatbots is the possibility of collecting and processing data on student performance and progress over time and generating a record of their interactions. This can be useful for faculty and other educators looking to assess student progress and provide appropriate feedback. in addition, through the collection and analysis of data from students' dialogues with the assistant, chatbots enable a greater personalization of the learning experience, providing help or messages tailored to the profile of each learner (Kukulska-Hulme et al., 2021). For example, educational chatbots can emulate a teacher conducting a formative assessment by evaluating students' knowledge with multiple-choice questions (Kuhail et al., 2023).

Chatbots can also help automate the grading of assignments in Massive Open Online Courses (MOOC). Ndukwe et al., (2019) explored the idea of an automated grading system using a Chatbot that asked students questions, requiring short written responses graded by a Chatbot. They can provide valuable information in a timely manner, as well as guide learning by including selfassessment functions.

Limitations of chatbots for the development of deeper learning

We have highlighted the possibilities that chatbots offer in the learning and teaching process, however, it is essential to critically examine their limitations, particularly those related to the development of deeper learning (Shelkande, 2023).

- Limited contextual understanding: While they can provide information based on predefined patterns and databases, they lack the capacity to grasp the nuanced context of a student's inquiry. This limitation results in responses that may miss the mark when it comes to addressing the unique learning requirements of individual students. Deeper learning involves a nuanced understanding of concepts, and the inability of chatbots to adapt to different contextual cues can hinder the depth of comprehension achieved.
- Lack emotional intelligence: Deeper learning often encompasses emotional engagement and the ability to empathize with the learner's state of mind. Chatbots, driven by artificial intelligence, often fall short in this aspect. They are not equipped to effectively respond to the emotional and motivational dimensions of learning, which are integral to deeper understanding and long-term knowledge retention.
- Reliance on existing data can limit their capacity to foster higher-order cognitive skills: Chatbots predominantly excel at information retrieval. Their primary function is to retrieve facts and provide answers to factual questions. While this is valuable for surface-level knowledge acquisition, deeper learning transcends mere information recall. It requires critical thinking, problemsolving, and the synthesis of knowledge. Fourthly, the assessment capabilities of chatbots often focus on basic quizzes and factual questions. While these are useful for gauging foundational knowledge, they are inadequate for evaluating higher-order skills, such as application, analysis, and creativity, which are central to deeper learning. The inability of chatbots to provide meaningful feedback on these advanced skills is a substantial limitation. On the other hand, insufficient or inadequate dataset training can cause frustration and be another important limitation to formative feedback using a chatbot (Kuhail et al., 2023).
- Absence of human interaction: Deeper learning often thrives in environments where students can engage with peers and interact with educators. Chatbots, by design, exclude the human element from the learning process. This lack of genuine human interaction can constrain the development of social and collaborative skills, which are essential for deeper learning. Moreover, the absence of human mentors and role models can diminish motivation and the depth of understanding attainable.
- **Difficulty generating inclusive environments**: An important limitation of chatbots designed as assessment systems is the possibility of perpetuating systemic bias and discrimination by favoring dominant ways of thinking. These tools can increase student monitoring and surveillance, jeopardizing student

autonomy, disadvantaged traditionally marginalized students, and amplifying racism, sexism, xenophobia, and other forms of inequity (Trust et al., 2023).

Thus, although chatbots are tools with multiple pedagogical and didactic possibilities, their use requires a previous level of literacy in their use, both on the part of teachers and students.

Experiences using chatbots in higher education

This section shows several experiences in the use of chatbots in higher education in universities from different countries. Each case analyzed includes the number of participants, the objectives of the experience, the methodology for developing the chatbot and/or the type of research carried out, the implementation period, as well as the results obtained.

Case 1. KNUSTbot.

- <u>Field</u>: Multimedia programming.
- <u>University</u>: Kwame Nkrumah University of Science and Technology (KNUST).
- <u>Country:</u> Republic of Ghana.
- <u>Authors:</u> Essel et al (2020).
- Number of participants: 68
- Objectives:
 - To determine if there exists a significant difference in academic results between students who interact with a chatbot and students interacting with a course instructor.
 - To know the perceptions of the experimental cohort on the chatbot as a means to facilitate their learning.
- Methodology to develop the chatbot:
 - KNUSTbot was developed using WhatsApp instant messaging app and Flow program, a Natural Language Processing platform that can build human-like conversational AI.
 - Two experienced multimedia programming experts and an instructional designer verified the KNUSTbot.
- Type of research:
 - Quasi-experimental pretest-posttest design in combination with a qualitative research method (focus groups).
 - Experimental group: face-to-face instruction and interaction with chatbot on the WhatsApp group platform.
 - Control group: face-to-face instruction and interaction with facilitator on the WhatsApp group platform.

- Implementation period: April- August 2021.
- Results:
 - Students in the experimental cohort who engaged with the chatbot performed better than students in the control cohort who interacted with the course instructor.



Figure 4. Interface of KNUSTbot. Source: Essel., et al (2022).

Case 2. UIBOT, a conversational chatbot implemented in Moodle.

- <u>Field:</u> Business Administration and Management.
- <u>University:</u> University of Balearic Islands.
- Country: Spain.
- Authors: Rejón-Guardia & Gabriel Àngel Vich-i-Martorell.
- Number of participants: 240.
- Objectives:
 - To identify, design and co-create the most appropriate didactic resources to be implemented in each of the subjects through the virtual assistants.
 - To support the autonomous learning of the students in e-learning platforms.
 - To enhance students' ability to implement new technologies in virtual environments.
 - To make faculty reflect on the present and future learning needs of students.
 - Accompany students through the immediate and ubiquitous assistance of the implemented chatbot.

- To reduce students' stress levels and increase their control over subject knowledge.
- Methodology to develop the chatbot:
 - The chosen platform was Pandorabots, an opensource framework to build and publish AI-powered chatbots on the web, mobile applications, or messaging apps.
 - Workshops were conducted with students about their previous experience with conversational assistants and whether they believed they could be useful in higher education.
 - An online, self-administered questionnaire was created. Open-ended questions were included so that the student could describe the different elements they preferred for the chatbot and why.
 - Chatbot configuration and implementation in Moodle.
 - Assessment of chatbot acceptance by means of a questionnaire.
- Type of research:
 - Quasi-experimental pretest-posttest.
- Implementation period: 2019-2021.
- Results:
 - Importance of establishing a co-creation and codesign a co-creation and co-design phase in which work is done jointly with the end-user.



Figure 5. Interface of UIBOT. Source: Rejón-Guardia & Gabriel Àngel Vich-i-Martorell (2023).

Case 3. Arturito Bot

- Field: Law.
- <u>University:</u> Universidad Privada del Norte.
- Country: Perú.
- <u>Authors:</u> Uceda et al., (2023).
- Number of participants: 51
- Research objectives:
- To develop and implement an informative chatbot for students enrolled in the course Introduction to Law.
- To evaluate the impact of a chatbot as a self-regulation strategy for remote learning for students enrolled in the course Introduction to Law.
- To determine the initial and final level of self-regulation of the students enrolled in the course Introduction to Law.
- Methodology to develop the chatbot:
 - Telegram was chosen as the technology for student interaction.
 - The teacher established the methodology to validate the requirements and learning rules of the bot.
 - Brainstorming sessions to validate the coherence, relevance, and sufficiency of the rules.
 - The software development team carried out the chatbot analysis, design, and development of the chatbot, and established rules for the requirements, including material and multimedia content.
 - Measurement of chatbot quality based on the ISO 9126 base standard.
- Type of research:
- Quasi-experimental pretest-posttest.
- Implementation period: 2020-2022.
- Results:
 - The chatbot positively impacted: 1) active metacognitive awareness; 2) daily effort in task completion; 3) control and verification of daily effort in task completion; and 4) active processing while classes are in progress.
 - The use of chatbots has increased interest among students who are using this technology for the first time.



Figure 6. Interface of Arturito bot. Source: Uceda et al (2023).

Case 4. Textit

- <u>Field</u>: Bachelor of Education (Teaching English to Speakers of Other Languages (TESOL).
- <u>University</u>: Universiti Sains Malaysia.
- <u>Country</u>: Malaysia.
- <u>Author</u>: Kuhail (2023).
- Number of participants: 60
- Research objectives:
 - To facilitate group work collaboration around a project-based activity.
 - To evaluate the difference in learning outcomes based on the impact of an educational chatbot on a project-based learning activity.
 - To explore how the introduction of educational chatbot influences learning performance, need for cognition, motivational belief, creative self-efficacy, perception of learning, and teamwork.
- Methodology to develop the chatbot:
 - Chatbot designed as a teaching assistant using Telegram.
 - Students worked in a group of five during the ten weeks, and the ECs' interactions were diversified to aid teamwork activities used to register group mem-

bers, information sharing, progress monitoring, and peer-to-peer feedback.

- 10 ECs were deployed throughout the semester; where EC1-EC4 was used for administrative purposes, EC5-EC6 for assignment; EC7 for user feedback and acceptance; EC8 for monitoring teamwork progress; EC9 as a project guide FAQ; and EC10 for peer-to-peer assessment.
- Research approach:
- Quasi-experimental pretest-posttest.
- Implementation period: ten weeks.
- Results:
 - The educational chatbot has influenced learning performance and teamwork, and a significant impact on the outcome was deduced.
 - Other outcomes such as the need for cognition, motivational belief, creative self-efficacy, and perception of learning did not reflect significant differences between both groups.



Figure 7. Interface of Textit. Source: Kuhail (2023).

Case 5. Cleverbot

- <u>Field</u>: English as Foreign Language.
- <u>University</u>: Not indicated (a private university in Western Japan).
- <u>Country</u>: Japan.
- <u>Authors</u>: Fryers et al (2017).
- Number of participants: 122 students.
- Research objectives:
 - To test of the effectiveness of chatbot partners for increasing interest in language learning.
 - To analyze the Clevebot's interactions.

- To examine the difference between students' interest in classroom speaking tasks under conditions of Chatbot and Human partners.
- Type of research:
 - Quasi-experimental pretest-posttest.
 - Counterbalanced design, at three-week intervals students engaged in separate speaking tasks with each of a Human and "Chatbot" partner.
 - Students' interest in successive tasks and in the course (pre-post) were used to assess differential partner effects and course interest development trajectories.
- Implementation period: twelve weeks.
- Results:
- Only task interest with the Human partner contributed to developing course interest.
- While Human partner task interest predicted future course interest, task interest under Chatbot partner conditions did not.
- Tasks seeking to stimulate task interest, and apparently succeeding, might be no more than novelty effects (Fryers, 2018, p.21).

Case 6. Feedbot & Litbot

- <u>Field</u>: Educational Science.
- <u>University</u>: Leipzig University.
- <u>Country</u>: Germany.
- <u>Authors</u>: Neumann et al. (2021).
- Number of participants: 700 students.
- Research objectives:
 - To integrate different mentoring tools to support students' self-study activities using chatbots.
 - To develop and implement two chatbots to support students of educational sciences in their self-study of the seminar topics and literature.
- Methodology to develop the chatbot:
 - Collection of possible student intentions and corresponding example sentences with matching responses from the bot in a spreadsheet.
 - To set off generic messages (greetings, saying goodbye, referring to other contacts for help or reacting to expressions of gratitude or bad behavior), as well as scenario-specific messages.
 - To set of Frequently Asked Questions (FAQ).
 - To create the chatbots using the Social Bot Framework (SBF), a Web-based collaborative modeling tool.

- To generate and visualize automated feedback on writing tasks, the FeedBot utilizes the REST API of T-MITOCAR, a software applying computational linguistics to analyze the knowledge structures of a text and visualize it in a graph representation.
- Type of research:
 - Evaluation of the applicability of created bots with the help of SBF.
 - Evaluation of the two chatbots using usability questionnaires.
- Implementation period: Winter term 2020/2021.
- Results:
- Interaction plays an important role in the use of chatbots in higher education.
- 715 students used Feedbot to submit over 8,400 text documents in total. Initial insights showed that students rarely used the bot in an exploratory way.
- Regarding Litbot, most students stated that the chatbot could motivate them to read a seminar text and support their self-study (Neuman et al., 2021, p. 6).



Figure 8. Simplified model of the LitBot and chat conversation. Source: Neumann et.al (2023: 5). Case 7. BOT0210

- Field: Computing.
- <u>University</u>: Universidad Estatal a Distancia.
- <u>Country</u>: Costa Rica.
- Authors: Ávalos & Monge (2020).
- Number of participants: 202 students.
- Research objectives:
 - Design of the chatbot tool to support teaching in the subject Introduction to Computing (0210) to speed up teach-

ing management during the social distancing in the pandemic.

- To know the frequency and usage of the chatbot tool.
- Identify the advantages of using tools with AI algorithms to support the work of teachers.
- Methodology to develop the chatbot:
 - The Chatfuel platform was selected to implement "Bot0210", since it can be configured to use the message delivery engine of Facebook's Messenger.
 - Tracking of frequent academic and administrative queries from students of the course.
 - Validation of the tool with a team of experts.
 - Performance of testing and validation processes.
 - Data collection instrument: questionnaire.
- <u>Implementation period</u>: January-April 2020.
- Results:
- The tool helped to address academic doubts about the subject.
- 80% of the sample agreed with implementing the tool in other subjects.
- More than 80% agreed that learning to use the chatbot was quick and did not require extra explanation to understand the dynamics of use.
- More than 75% of the students indicated that they found the tool's interface user-friendly and easy to use.



Figure 9. Evidence of the final phase of chatbot design. Source: Ávalos & Monge (2020). Case 8. Goal-setting chatbot and Learning Buddy chatbot.

- <u>Field</u>: English as Foreign Language in fully online classes.
- <u>University</u>: The University of Hong Kong.
- <u>Country</u>: China.
- <u>Authors</u>: Hew et al (2023).
- Number of participants: 67 students.
- Research objectives:

- To study the effects of the goal-setting chatbot and the learning buddy chatbot on students' behavioral engagement in online learning.
- To analyze students' perceived usefulness and ease of use of the two chatbots.
- To analyze students' perceptions of goal-setting process and social presence supported by the chatbots.
- Methodology to develop the chatbots:
 - The goal setting chatbot engaged participants with five questions developed based on the SMART (specific, measurable, achievable, realistic, and timely) goal setting framework.
 - The learning buddy chatbot was designed based on the social presence framework (interpersonal communication, open communication, cohesive communication) to guide students through listening exercises.
 - Google Dialogflow was used to build the chatbot.
 - The chatbots were integrated into Moodle via embedded code and presented in a format of activity page.
- Type of research:
 - Qualitative research.
 - Instruments: conversation records with the chatbots, questionnaires, and in-depth interviews.
- <u>Implementation period</u>: January-April 2020.
- Results:
- They found positive learner experiences with both chatbots regarding the chatbots' perceived usefulness and perceived ease of use.



Figure 10. Goal-setting chatbot in Moodle system. Source: Hew et al (2023:50).

A reflection on the potential of Chat GPT- 3.5 for higher education

Chat GPT- 3.5 was launched in November 2022 and newer version Chat GPT 4 in March 2023 by the AI research and development company OpenAI. It is a tool based on user interactions and feedback. Although it is still in the process of development and improvement, its ability to generate texts quickly has been a great surprise among the academic community.

Chat GPT can easily answer questions, produce essays, resolve problems, or write song lyrics. You can ask it to summarize an article in a way that a primary school student can understand it; sort by importance a list of books and make a summary of each one of them; or develop a narrative text with the desired length or even the style of writing. Chat GPT is certainly going to change how students write their papers.

However, this ability to build content is being viewed with some suspicion by faculty. Chat GPT can express itself in a natural way, which makes it very difficult to distinguish that the text has been generated by AI. This obviously poses a challenge in the learning assessment process. How can we encourage students to use Chat GPT as a tool to facilitate learning and not as a fast track to submit an assignment?

There are many voices from the academic field calling for caution with the use of this tool. The main problems of Chat GPT are related to its reliability. An example of that, or the same question, sometimes it gives correct information, but sometimes it does not. On other occasions, he invents information (including bibliographical references) or shows unreal data. This will probably be improved in future releases with better integration with academic sources (Nikolic et al., 2023).

When ChatGPT was asked abouts its advantages for higher education, the following points was the direct output: the possibility of accessing instant information and resources at any time and from anywhere, individualized support and personalized tutoring. Chat GPT is supposed to be able to adapt its responses based on the specific requirements and knowledge level of each student, offering tailored explanations, examples, and resources. Creativity when asking questions can be key to obtaining surprising results. This is due to the fact it is a very sensitive tool to the text of the question, the prompt. Using one preposition or another can determine the answer.

Chat GPT generates responses based on patterns it has learned from training data, which may include both accurate and inaccurate information. By providing an already designed text, it omits the previous phase of information selection, where students need to contrast various sources of information and evaluate its accuracy or credibility. This process of searching and selecting information is different from the one that takes place when using a search engine. A Google search yields a number of web pages that may or may not be useful or even contain erroneous information. However, the learner can evaluate it for himself/ herself and select the information he/ she deems appropriate. With ChatGPT the student gets a ready-made text, something like a Wikipedia page, and it will be very difficult to detect where the errors are. Given its ability to produce pre-digested information, it can undermine students' ability to create and anticipate proposals (Diego et al., 2023).

At this point, it is worth asking: in what ways can students develop critical thinking with Chat GPT? Could the use of this tool limit or promote the development of this skill? Is Chat GPT a useful tool for obtaining facts or rather for obtaining ideas? Some of the ways in which Chat GPT can develop students' critical thinking are asking thought-provoking questions, providing constructive feedback so that students can revise their arguments, asking students to provide evidence for their claims or arguments, presenting different perspectives or approaches to a topic, or engaging students in open-ended discussions. However, it is important to note that Chat GPT only gathers information from Internet databases and texts, so it also learns any cognitive biases found in such information (Sabzalieva & Valentini, 2023). Therefore, it is necessary for students to be critical of the information provided by the tool and to be careful with the sources used. Thus, it seems necessary that the student has previous knowledge about the subject of study, otherwise he/she will not be able to interpret and critically analyze the answers offered by the tool. in this regard, chatbots can serve as valuable partners in this endeavor by encouraging students to cross-reference information, critically assess the credibility of sources, and challenge preconceived notions. By prompting students to inquire further, compare responses, and validate information from various sources, chatbots complement the development of robust critical thinking skills, preparing learners to navigate the complex web of information available in the digital age.

Below is an example created by Chat GPT - 3.5 in which it simulates a conversation to illustrate how it can guide a student to understand different perspectives on an issue.

show me an example of this

Student: I'm having trouble understanding the ethical implications of genetic engineering. Can you help me explore different perspectives on this topic?

Chat GPT: Certainly! Let's delve into the subject. From an ethical standpoint, there are various perspectives on genetic engineering. One viewpoint argues that it has the potential to alleviate human suffering by eliminating genetic diseases and improving overall health. Proponents believe that we have a moral obligation to utilize this technology for the betterment of humanity. On the other hand, some critics raise concerns about the potential for unintended consequences and the ethical implications of altering the fundamental aspects of human nature. They emphasize the importance of respecting the autonomy of future generations and the potential for widening socio-economic inequalities. What are your initial thoughts on these perspectives?

Student: I hadn't considered the potential for unintended consequences or the impact on future generations. Could you provide me with additional resources that present these viewpoints in more detail?

Chat GPT: Absolutely! Here are a few resources that delve deeper into the ethical implications of genetic engineering from various perspectives:

- 1. Article: "The Ethics of Genetic Engineering" by Dr. Emily Williams
- 2. Video: "Exploring Ethical Dilemmas in Genetic Engineering" by TED-Ed
- 3. Book: "Genetic Engineering and Ethics" by Dr. Michael Stevens

These resources should provide you with a range of viewpoints and arguments to further explore the subject matter. Remember to critically evaluate the information and consider how these perspectives align with your own values and beliefs.

Student: Thank you! I appreciate your help. I'll dive into these resources and continue exploring the different perspectives on genetic engineering.

Chat GPT: You're welcome! Feel free to return if you have any more questions or need further assistance. Happy exploring!

Figure 11. Conversation with Chat GPT. Source: own elaboration.

Another important question is whether it could increase student motivation. When asking Chat GPT, it indicates that the interactive conversations generated make the student actively involved in their learning process. to what extent can this be true? Is the student really looking for quick answers or does he/she want to interact with Chat GPT to research a topic in depth?

If we ask Chat GPT in which way it can guide the student to explore different perspectives and develop a deeper understanding of the subject matter, it indicates the following possibilities: presenting alternative viewpoints or counterarguments, generating open discussions, challenging each other's ideas, consider different perspectives, and evaluate the strengths and weaknesses of various arguments. However, how does Chat GPT engage the students to ques-

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tion their assumptions and develop a more nuanced understanding of the topic? Below we can see an example of a conversation with Chat GPT-3.5:

SR	You say Chat GPT can ask thought-provoking questions that require students to analyze information. Can you give me an example?
\$	Certainly! Here's an example of a thought-provoking question that Chat GPT can ask to
	encourage students to analyze information:
	Chat GPT: "Consider the issue of climate change. Based on the scientific consensus that
	human activities contribute to global warming, what are the potential consequences of
	inaction? How might these consequences vary in different regions of the world? Please
	analyze the information available and provide evidence to support your analysis."
	This question prompts students to critically analyze the issue of climate change and its
	potential consequences. It encourages them to consider the scientific consensus and the
	impact of human activities on global warming. Additionally, it asks students to think about
	the potential regional variations in consequences, acknowledging that different parts of the
	world may be affected differently.
	By asking for evidence-based analysis, the question prompts students to delve into
	scientific research, examine data, and evaluate the potential consequences of inaction on
	climate change. Students are encouraged to think critically, apply their knowledge, and
	develop a well-supported response that considers different factors and perspectives.
	Engaging in a discussion with Chat GPT, students can present their analysis, explore
	different dimensions of the issue, and consider the complexities surrounding climate
	change. This type of thought-provoking question fosters critical thinking by challenging
	students to analyze information, consider multiple viewpoints, and construct well-reasoned
	arguments based on evidence.

Figure 12. Conversation with Chat GPT. Source: Own elaboration.

However, when asked about its potential for tutorial support, Chat GPT admits to having limitations, mainly the model's reliance on pre-existing data and potential biases in responses. Specifically, it recognizes possible stereotypes related to gender, race, ethnicity, religion, or other sensitive attributes. Biases can also emerge in the form of imbalanced representation or skewed perspectives on certain topics. Chat GPT can "reproduce false and true ideas or assume ethical and unethical positions, without commitment to its contributions and indifferent to their consequences" (Olite, Morales & Lledo, 2023: 18). in this regard, the lack of female participation in AI research and development has been highlighted, as well as the power of generative AI to produce and disseminate content that discriminate against or reinforce gender and other stereotypes (Sabzalieva & Valentini, 2023). Another aspect that requires close attention is access to these technologies, which could lead to even greater inequalities. The cost of subscriptions, geographical restrictions, access to computers and Internet connection, accessibility problems for people with disabilities, or the availability of these tools in other languages.

On the other hand, concerns about the potential for ChatGPT to jeopardize academic integrity have arisen (Nikolic et al., 2023) due to its ability to pass assessments and mislead experts. Students must also understand the risk involved in using this tool. For example, they may incur the risk of plagiarism if they copy verbatim the texts generated by Chat GPT, which in turn may be verbatim copies of copyrighted texts. in fact, universities around the world have banned ChatGPT due to these concerns, and others have updated or changed the assessment procedures, relying on in-class or non-written assignments (Sabzalieva & Valentini, 2023).

Faculty should provide guidelines and evaluation criteria to assess the information. Given the inevitable use of applications such as Chat GPT, the best alternative to preserve meaningful learning will be to encourage the construction of knowledge through discussions and activities aimed at detecting bias, analyze multiple perspectives, and question the information. Fostering critical thinking, creativity, communication, and collaboration in students will be a must to effectively use this tool. to achieve an adequate use of Chat GPT, responsibility and integrity in the learning process must be fostered. in fact, its raises policy questions around privacy and intellectual property rights, liability and accountability, and concerns about their potential to spread disinformation and misinformation.

In addition to these essential principles, it is crucial to establish clear mechanisms for ongoing monitoring and assessment of chatbot interactions in educational settings. Faculty members should regularly review the chatbotgenerated content to identify any emerging ethical concerns, biases, or potential issues related to privacy and transparency. Furthermore, it is advisable to maintain an open line of communication with students, encouraging them to report any uncomfortable or problematic interactions with the chatbot. This feedback loop ensures that the use of chatbots in education remains ethical, transparent, and privacy conscious. By continuously refining these guidelines and maintaining open channels of communication, educational institutions can harness the potential of chatbots while upholding the highest standards of ethical use.

In terms of ethics, it is advisable to consider as a framework for action international agreements such as the Beijing Consensus on Artificial Intelligence and Education, during the International Conference on Artificial Intelligence in Education held in Beijing, 16-18 May 2019 (UNESCO, 2019) and to keep up to date with the corresponding regulatory framework, such as the European one (European Commission, 2021). Despite the development of AI, there is a notable paucity of empirical research focusing specifically on the use of chatbots and ChatGPT in education (Wu & You, 2023). More empirical research is required to develop a better understanding of the effects of ChatGPT on higher education. For example, what stages or moments of the learning cycle will students be able to better access, reflect on and integrate all the information provided by ChatGPT, or the ethical implications of using this tool.

Recommendations to introduce chatbot in higher education courses

The use of chatbots in education is becoming increasingly prevalent, but at the same time there is concern about the absence of a pedagogical approach in the design of educational chatbots. in fact, their development seems to be driven more by technological issues than by a clear pedagogical approach to foster the acquisition of learning outcomes (Hew, 20023). in this sense, as a result of the analysis of the eight cases seen above, some recommendations for introducing chatbots in higher education courses are offered. These recommendations, which are not intended to be exhaustive, are related to usability, instructional design, student experience, and assessment.

Usability:

- Involve the students throughout the process of co-creation, implementation, and subsequent feedback.
- Assure that the type of content and functionality included in the chatbot should be useful and relevant to students and faculty.
- The chatbot should be easy to access.
- Consider the quality criteria of the chatbot, as they have a direct impact on its acceptance and use.
- Keep it simple: design a user-friendly interface that focuses on the essential elements.
- Consider how the chatbot will integrate with other learning tools and platforms used by students and teachers.
- Start using platforms that do not involve coding and that allow scalability and adaptation (e.g., Pandorabots, Botpress, Google Dialogflow, etc.).

Instructional design:

- Assure that the chatbot provides learning content and activities aligned with the learning outcomes.
- The chatbot should help students set personal learning goals concerning the course they attended.
- The chatbot should employ specific communication strategies to project social presence into its interaction with participants.
- Interaction with the chatbot should be based on small learning units.

- Build a basic knowledge base: collect and design predicted learning inputs, break down and classify the inputs, design dialogue as possible responses, compile the most frequently asked questions of students.
- Establish starting questions that allow for dialogue, collaboration, and student reflection.
- Offer the students the opportunity to explore additional resources with images, slides, articles, videos.
- If the chatbot is intended to support the learner in completing tasks, it should identify where the learner is in the task. The chatbot must be able to reply to students' inputs and guide them step by step to complete the tasks.
- Provide the scaffolding for the learner to address different topics and reflect.
- Provide advice, information, and reflective questions.
- Employ specific communication strategies to project social presence into its interaction with participants.
- Do trial tests to measure and update the accuracy of responses by training the chatbot with known answers.

Student experience:

- Ensure that the chatbot provides immediate feedback to the student.
- Foster chatbot interaction by applying text, speech, graphics, haptics, gestures, and other modes of communication.
- Chatbot should greet students every day when they enter the system, address students' name during the conversation, and use inclusive pronouns.
- Affective interaction such as greetings, humor, emojis, and/or empathy should also be included to improve emotional engagement.
- Consider how the privacy and security of chatbot users will be protected.

Assessment:

- Include active learning and communication strategies that allow the instructor to monitor learning progress.
- Consider how to evaluate and validate the chatbot to ensure its effectiveness and efficiency in learning. Artiles et al (2022) recommend a widely used and validated instrument called System Usability Scale (SUS).

Conclusions

We suggest approaching the potential of chatbots not as a problem, but as a challenge for faculty, who must appeal to the commitment and responsibility of the students with the subject to be studied. The following are brief recommendations for faculty and institutions for the adoption of chatbots in higher education.

Recommendations for faculty:

- 1. Focus the design of the course on the development of competencies, not on content.
- 2. Connect the use of chatbots with the course learning outcomes.
- 3. Use chatbots as assistants to adapt contents to the students' needs. We can ask it to adapt it for students with disabilities or special educational needs, students who do not have sufficient background in one or some of the specific topics of the subject, students who need a motivating challenge to explore it further, etc.
- 4. Promote meaningful learning through real cases, problem-based learning, service-learning, debates, project-based learning, discussions, debates, etc.
- 5. Teach students to make specific and direct prompts, avoiding the use of complex or ambiguous sentences. Consider different levels of difficulty of the prompts, depending on the students' levels of knowledge on a given topic.
- 6. Allow the work submissions can have very varied and, if possible, more creative models (podcasts, reflective notebooks, web pages, videos, student interviews, Instagram reels, etc.). in this way we will encourage students' deep learning and adapt to different learning styles.
- 7. Ask for oral presentations from the students, so that they can develop their skills in arguing, understanding the material, etc. These oral presentations are excellent opportunities to find out to what extent a subject has been understood.
- 8. Be creative and innovative in your assessment formats: request personal reflections, critical analysis of results, original proposals from the students, selfevaluations, etc.
- 9. Rethink evaluation criteria for assignments.
- 10. Ask the students for feedback on the procedures they followed to do the work.

Recommendations for higher education institutions:

- 1. Review and update institutional policies regarding academic integrity in relation to the use of chatbots.
- 2. Provide clear guidance so that students and faculty know how and when these tools can be used.
- 3. Create working groups for faculty, students, and other stakeholders to discuss the impact of chatbots and design strategies for using them appropriately.
- 4. Create programs related to AI literacy and ethics.
- 5. Encourage peer-to-peer mentoring for faculty members to increase their skill level and share good teaching practices to use chatbots.
- 6. Train faculty, researchers, and students to improve the use of prompts.

Finally, we include an infographic to guide students in the use of AI in the classroom.



Figure 13. Guidelines for the use of AI in the classroom.

Source: Own elaboration.

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Bibliography

- Anderson J., Corbert A., Koedinger K., y Pelletier R. (1995). Cognitive Tutors: Lessons Learned. The Journal of the Learning Sciences, 4 (2), 167-207.
- Artiles Rodríguez, J., Guerra Santana, M., Aguiar Perera, M. V., & Rodríguez Pulido, J. (2021). Agente conversacional virtual: la inteligencia artificial para el aprendizaje autónomo. Pixel-Bit, 21, 107-144.
- Monge Mata, L., & Ávalos Dávila, C. (2020). BOT0210, una herramienta de apoyo a la docencia. Experiencia de la Cátedra Tecnologías de la Información de la UNED, Costa Rica. Revista Innovaciones Educativas, 22, 188-199.
- Brustenga, G. G., Alpiste, M. F., & Castells, N. M. (2018). Briefing paper: chatbots in education. https://doi.org/10.7238/elc.chatbots.2018
- Castejón, J.L. (1997). Introducción a la psicología de la instrucción. Club Universitario.
- Chen, H., Widarso, G., & Sutrisno, H. (2020). A ChatBot for Learning Chinese: Learning Achievement and Technology Acceptance. Journal of Educational Computing Research, 58, 161 – 1189.
- Clarizia, F., Colace, F., Lombardi, M., Pascale, F., & Santaniello, D. (2018). Chatbot: An education support system for students. in Cyberspace Safety and Security: 10th International Symposium, CSS 2018 Amalfi, Italy, October 29–31, 2018, Proceedings 10 (pp. 291–302). Springer International Publishing.
- Dimitriadis, G. (2020). Evolution in education: chatbots. Homo Virtualis, 3(1), 47-54. https://ejournals.epublishing.ekt.gr/index.php/homvir/article/download/23456/19700
- Durall Gazulla, E., Martins, L., & Fernández-Ferrer, M. (2023). Designing learning technology collaboratively: Analysis of a chatbot co-design. Education and Information Technologies, 28(1), 109-134. https://doi.org/10.1007/s10639-022-11162-w
- European Commission. (2021). Proposal for a Regulation laying down harmonized rules on artificial intelligence (Artificial Intelligence Act). Brussels: European Commission. https://digitalstrategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonisedrules-artificial-intelligence-artificial-intelligence
- Gan, C., Chen, S., & Chen, G. (2017). The effect of personalized learning on student motivation and performance: A review. Educational Technology Research and Development, 65(5), 1019-1039.
- González, C. (2004). Sistemas inteligentes en la educación: una revisión de las líneas de investigación y aplicaciones actuales. RELIEVE, 10, (1), 3-22.
- Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. International Journal of Educational Technology in Higher Education, 19(1), 1-19.
- Francisco Rejón-Guardia y Gabriel Àngel Vich-i-Martorell (2023). El valor de la cocreación para la intención de uso de chatbots: una experiencia de implementación en educación superior. En M. Fernández-Ferrer, M. (ed.), Chatbots en educación. Tendencias actuales y desafíos futuros (pp. 67-92). LMI. (Colección Transmedia XXI).
- Fryer, L. K., Ainley, M., Thompson, A., Gibson, A., & Sherlock, Z. (2017). Stimulating and sustaining interest in a language course: An experimental comparison of Chatbot and Human task partners. Computers in Human Behavior, 75, 461-468. https://doi.org/10.1016/j.chb.2017.05.045
- Gan, C., Chen, S., & Chen, G. (2017). The effect of personalized learning on student motivation and performance: A review. Educational Technology Research and Development, 65(5), 1019-1039.
- Hew, K.F., Huang, W., Du, J. (2023). Using chatbots to support student goal setting and social presence in fully online activities: learner engagement and perceptions. Journal of Computing in Higher Education, 35, 40–68. https://doi.org/10.1007/s12528-022-09338-x
- Jonassen, D. (2000). El diseño de entornos constructivistas de aprendizaje. En C. Reigeluth (Ed.). Diseño de la instrucción. Teoría y modelos. Parte I. (pp. 225-249). Aula XXI Santillana.
- Khidir, M., Saari, S., & Zawawi, M. (2022). The effectiveness of artificial intelligence chatbot for teaching computer-aided design (AUTOCAD) in polimas. EPRA International Journal of Multidisciplinary Research (IJMR), 8(5), 208-214. https://doi.org/10.36713/epra10334

- Kim, N. Y., Cha, Y., & Kim, H. S. (2019). Future English learning: Chatbots and artificial intelligence. Multimedia-Assisted Language Learning, 22(3).
- Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2023). Interacting with educational chatbots: A systematic review. Education and Information Technologies, 28(1), 973-1018.
- Kukulska-Hulme, A., Bossu, C., Charitonos, K., Coughlan, T., Maina, M., Ferguson, R., FitzGerald, E., Gaved, M., Guitert, M., Herodotou, C., Prieto-Blázquez, J., Rienties, B., Sangrà, A., Sargent, J., Scanlon, E., Whitelock, D. (2022). Innovating Pedagogy 2022: Open University Innovation Report 10. Milton Keynes: The Open University.
- Kumar, J. A. (2021). Educational chatbots for project-based learning: Investigating learning outcomes for a team-based design course International Journal of Educational Technology in Higher Education, 18(1), https://doi-org.bucm.idm.oclc.org/10.1186/s41239-021-00302-w
- Li, Y., Chen, S., & Zhang, J. (2016). The impact of chatbots on customer satisfaction and loyalty: A review. ACM Transactions on Management Information Systems, 7(1), 1-19.
- Liu, C., Chen, S., & Chen, G. (2018). The effect of personalized feedback on student motivation and performance: A review. Educational Technology Research and Development, 66(5), 883-901.
- Marcus, G. (30th June 2023). How come GPT can seem so brilliant one minute and so breathtakingly dumb the next? https://garymarcus.substack.com/p/how-come-gpt-can-seem-so-brilliant
- Martins, L. (2023). Una introducción a los chatbots y sus aplicaciones en educación. in M. Fernández-Ferrer, M. (ed.), Chatbots en educación. Tendencias actuales y desafíos futuros (pp. 15-38). LMI. (Colección Transmedia XXI).
- Merelo, J. J., Castillo, P. A., Mora, A. M., Barranco, F., Abbas, N., Guillén, A., & Tsivitanidou, O. (2023). Chatbots and messaging platforms in the classroom: An analysis from the teacher's perspective. Education and Information Technologies, 1-36. https://doi.org/10.1007/s10639-023-11703-x
- Mohan, L. (2018). The impact of personalized learning on student motivation and performance: A review. Educational Technology Research and Development, 67(5), 1013-1032.
- Neumann, A. T., Arndt, T., Köbis, L., Meissner, R., Martin, A., de Lange, P., Pengel, N., Klamma, R., & Wollersheim, H. W. (2021). Chatbots as a tool to scale mentoring processes: Individually supporting self-study in higher education. Frontiers in artificial intelligence, 4, 668220. https://doi.org/10.3389/frai.2021.668220
- Nikolic, S., Daniel, S., Haque, R., Belkina, M., Hassan, G. M., Grundy, S., Lyden, S., Near, P., & Sandison, C. (2023). ChatGPT versus engineering education assessment: a multidisciplinary and multiinstitutional benchmarking and analysis of this generative artificial intelligence tool to investigate assessment integrity. European Journal of Engineering Education, 48 (4),1-56. https://doi.org/10.1080/03043797.2023.2213169
- Ndukwe, I. G., Daniel, B. K., & Amadi, C. E. (2019). A machine learning grading system using chatbots. in Artificial Intelligence in Education: 20th International Conference, AIED 2019, Chicago, IL, USA, June 25-29, 2019, Proceedings, Part II 20 (pp. 365-368). Springer International Publishing.
- Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. Computers and Education: Artificial Intelligence, 2, 100033. https://doi.org/10.1016/j.caeai.2021.100033
- Olite, S., Morales, I., y Lledo, M.J. (2023). Chat GPT: origen, evolución, retos e impactos en la educación. Educación Médica Superior, 37 (2), 1-23.
- Pérez, J. Q., Daradoumis, T., & Puig, J. M. M. (2020). Rediscovering the use of chatbots in education: A systematic literature review. Computer Applications in Engineering Education, 28(6), 1549– 1565. https://doi.org/10.1002/cae.22326
- Redondo Duarte, S. (2012). Evaluación de la aplicación del modelo pedagógico de UEM personal a estudios universitarios de grado y postgrado en modalidad online (Unpublished doctoral thesis), Universidad Europea de Madrid.
- Shah, S., & Rehman, A. U. (2018). A comprehensive review of chatbots in education. Artificial Intelligence Review, 50(1), 1-27.
- Shelkande, M. C., Mane, M. R., Baramati, S. V., & Sonawane, M. K. (2023). Comprehensive analysis of Chat GPT. The Online Journal of Distance Education and e-Learning, 11(2).
- Studente, S. (2022). "Hello, my name is differ!" the use of chatbots for providing collaborative study support to university students. in The Future of Online Education (pp. 337-350).
- Uceda, P.J., Polo, L.C., y Cruzado, G.A. (2023). La influencia de los chatbots en el aprendizaje remoto como una estrategia de autorregulación en tiempos de pandemia. in M. Fernández-Ferrer, M. (ed.), Chatbots en educación. Tendencias actuales y desafíos futuros (pp. 93-120). LMI. (Colección Transmedia XXI).
- UNESCO (2019). International Conference on Artificial Intelligence and Education, Planning Education in the AI Era: Lead the Leap, Beijing, 2019. https://unesdoc.unesco.org/ark:/48223/pf0000368303
- Sabzalieva, E., & Valentini, A. (2023). ChatGPT e inteligencia artificial en la educación superior: Guía de inicio rápido. UNESCO. https://bit.ly/30eYm2f
- Vijayakumar, B., Höhn, S., & Schommer, C. (2019). Quizbot: Exploring formative feedback with conversational interfaces. in Technology Enhanced Assessment: 21st International Conference, TEA 2018, Amsterdam, The Netherlands, December 10–11, 2018, Revised Selected Papers 21 (pp. 102-120). Springer International Publishing.
- Villegas-Ch, W., Arias-Navarrete, A., & Palacios-Pacheco, X. (2020). Proposal of an architecture for the integration of a chatbot with artificial intelligence in a smart campus for the improvement of learning. Sustainability, 12(4), 1500.
- Winkler, R., y Söllner, M. (2018). Unleashing the Potential of Chatbots in Education: A State-Of-The-Art Analysis. In: Academy of Management Annual Meeting (AOM). Chicago, USA. https://www.alexandria.unisg.ch/254848/
- Wang, J., Hwang, G. H., & Chang, C. Y. (2021). Directions of the 100 most cited chatbot-related human behavior research: A review of academic publications. Computers and Education: Artificial Intelligence, 2, 100023.
- Wang, X., Li, Y., & Chen, G. (2018). Chatbots in customer service: A review. ACM Transactions on Management Information Systems, 9(1), 1-20.
- Wong, A. (2022, April). The Design of an Intelligent Chatbot with Natural Language Processing Capabilities to Support Learners. in Journal of Physics: Conference Series (Vol. 2251, No. 1, p. 012005). IOP Publishing.
- Wu, E. H. K., Lin, C. H., Ou, Y. Y., Liu, C. Z., Wang, W. K., & Chao, C. Y. (2020). Advantages and constraints of a hybrid model K-12 E-Learning assistant chatbot. IEEE Access, 8, 77788-77801.
- Wu, R., & Yu, Z. (2023). Do AI chatbots improve students learning outcomes? Evidence from a metaanalysis. British Journal of Educational Technology. https://doi.org/10.1109/ACCESS.2020.2988252
- Zamora, J.L.; Bello, S.; Amado, T., Martín, M. (2020). Los chatbots como herramienta de apoyo a la enseñanza: una experiencia en el ámbito jurídico. in J.L. Manzano, S.B., Rodríguez, T.Y., Gonzalez, & M.M. Paciente (Coords.), Tecnologías educativas y estratégicas didácticas (pp. 682-692). UMA editorial.
- Zhou, X., Yang, Y., & Wang, Z. (2017). Chatbots in education: A review. ACM Transactions on Education, 8(1), 1-20.

EMBRACING ARTIFICIAL INTELLIGENCE IN EDUCATION: STRATEGIES FOR SUPPORTING LEARNING

Phil HILL^{*}

Introduction

The question of whether artificial intelligence (AI) is impacting education is no longer a matter for debate. AI is already influencing the established modes of teaching and learning. Even if institutions were to try and ban the technology, learners are aware of it and are adopting it at a faster pace than those who teach them. Therefore, instead of fighting against AI, we need to embrace the technology. However, embracing AI requires a particular approach to differentiate between its misuse and its usefulness as a tool that enhances the metacognitive characteristics that the most successful academic learners have. AI should be taught and used in a way in which learners understand its significance and its implications for ethical use. They should also learn that accumulated knowledge is used to make connections across a range of tasks and resorting solely to AI could be detrimental to learners in the long term.

Of course, there will continue to be misuse of AI, and there are already welldocumented examples of AI "beating" established systems, challenging the future of jobs, and even posing an existential threat in what it means to be human. However, AI makes mistakes, and its outputs, which may initially seem sound, can have erroneous and misleading outcomes. It is common practice to teach learners to approach certain sources with caution; for example, Wikipedia is a common unreliable source of information. Education can be approached from the standpoint of value added. Learners must understand the value that AI adds as a learning tool and not as a replacement for learning. Otherwise, it becomes a form of 'cognitive offloading' that leaves little room for genuine learning. This value is found through critical thinking skills, which learners must develop.

This chapter will use examples from the UK's, 16-18-year-old Further Education (FE) sector, which is typically a more vocational education compared to the traditionally academic routes, such as Advanced Levels (A-Level). Learners in FE are not considered as academic as their A-Level peers and are twice as likely to drop out of university (Chowen, 2022). However, there are useful

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applications with emerging AI technologies to support these learners and create the conditions for a level playing field.

Within the hierarchy of education in the United Kingdom, FE follows primary and secondary schooling with typical ages of between 16 - 18 for Level 3 study, and 18 - 21 + at Level 4 and Level 5, the equivalent of the first two years of university, or higher education (HE). Entry requirements are typically lower than those for their A-Level counterparts and learners are five times more likely to retake English General Certificate of Secondary Education (GCSE) exams at FE compared to those learners who remain at school (Porter, 2015, p. 5). This creates extra pressure on those learners who did not achieve the minimum English and Maths grade as they must complete lessons to support the re-sit in addition to their main curriculum. There is also a gap in the attainment, compared to their peers who have achieved at least the minimum grades, even within the same classrooms, where all learners occupy a broader spectrum of support than with other education settings. From a teaching perspective, this can stretch resources and reduce time for individual support. This in addition to a sector that faces continued pressure on its funding to deliver in these conditions (2015, pp. 3-4).

Case Studies

This chapter will primarily look at two learners studying at a FE college based in the UK. Both learners' study creative media courses at different levels and differing assessment structures. Learner A is studying a first year Level 3 Extended Diploma in Creative Media Practice (Pearson, 2020). Learner B is studying a higher education Level 4 Higher National Certificate (HNC) in Creative Media Production (Pearson, 2022). Both courses are known as a 'Business and Technology Education Council' (BTEC) qualifications typical of those available at FE Colleges, which are the more vocational and practical offerings by the UK awarding body, Pearson. These two case studies offer a useful snapshot into how AI is already being used in the classroom by learners and what effect that is having on learning. The structure for each course is slightly different, which also means that the use of AI is applied in a different way.



Figure 1 Pearson, The 5 Equal Assessment Criteria from BTEC Level 3 Nationals Creative Media Practice Specification, 2022. Online

The Level 3 course has an open framework with five learning outcomes (Informing Ideas, Problem Solving, Technical Skill, Professional Practice, Communication) and is based on continuing development over four modules during the two-year extended diploma (Fig 1). Whereas, the equivalent A-Level is more prescribed in what is expected of the learner and includes multiple written exams (Assessment and Qualifications Alliance (AQA), 2023). Learner A's course has been written to encompass a critical reflective mode of learning, utilising Graham Gibb's reflective cycle (Gibb, 1988) and also John Driscoll's 'The What?' model of structured reflection (2006) that simplifies this process for the learner. Research has already been conducted with learners on these courses to develop reflective approaches utilising Driscoll's simplified methodology, which has been beneficial to learners who were previously unable to respond to evaluation in any meaningful way: 'when learners are confronted with this many questions [from previous evaluation methods], they found it challenging to prioritise, leading to short answers that didn't go into any depth and lacked significant value for learner development' (Hill, 2022, p. 60).

After working closely with learners to develop a concise method ongoing reflection instead of solely focussing on the end of an assignment, outcomes were very different, more in depth and with greater value for the learning that had taken place: 'The learner ultimately develops the same critical thinking skills that Gibb promotes resulting that they are able to articulate to the same degree by the end of the assignment using more analytical language.' (2022, p. 61).

Breaking down reflection into concise smaller tasks, that are ongoing and part of the process of practical work, has become much more engaging for the learners who are typically studying at a further education college to avoid high levels of writing because these are skills that they have found the most challenging at school. This provides a good starting point that can be further evolved and tested with artificial intelligence to see if this method of reflection can be supported in a way that adapts and evolves to the needs of the learner – potentially offering actions and feedback based on their response: not in place of the teacher but in addition to them.

The Level 4 course is much more structured and prescribed than the Level 3 qualification with more modules, each with eight pass criteria, four merit criteria, and two distinction criteria that are divided between four learning outcomes. Level 4 is a noticeable jump from level 3 as would be expected from a higher education qualification. It also has a more academic driven framework that requires written assignment as part of each module. From this, we can make comparisons in the effectiveness of AI support within structured framework and less structured curriculum. Both learners and courses are useful to discuss within this chapter owing to the subjective nature of some of the delivery, assessment and feedback that is used to teach the curriculum. AI, as will be discussed later, can support well-defined evidence-based subjects, such as Maths and Science quite well, whereas it may be more challenging when argument and critical reflection, some of which is based on personal experiences of learning, is part of the process.

Learner A

As stated, Learner A studies a Level 3 extended diploma in Creative Media Practice. Usual entry requirements are a Level 2, or four GCSE qualifications that are graded at least at a 4 out of a maximum of 9. Entry into Level 3 Creative Media must also include at least a 4 in English Language, or an equivalent Level 2 qualification. Learner A's achievement was sufficient for entry onto media however, they received a grade 3 for English Language GCSE, meaning that they would be enrolled on a GCSE English program alongside main curriculum studies. As a result, they have an additional hour a week added onto their timetable and the additional pressure of completing their main course whilst preparing for a re-take exam.

Learner A has been identified as having Autistic Spectrum Disorder (ASD). As a result, they have access to an in class learning assistant (LA) who supports them to interpret and break down tasks as well as support and frameworks from the tutor. in addition, their support plan specifies additional clarification of any new work, use of assistive technology, and special exam arrangements of 25% extra time. Within the framework of the Level 3 qualification, this can be used as additional time to complete work for assessment, should they need it. Learner A has found it challenging to engage with the critical reflective parts of the curriculum. Their answers used very basic language that did not unpack the activity in any meaningful way. Learner A requires high levels of structure to complete tasks and was unable to articulate any of the challenges faced, which meant they did not ask for help when needed it. It was identified that owing to Learner A's ASD, they also did not communicate well, either with the tutor, the teaching assistant, or even their peers within the class. It was important to make regular checks and break down each instruction to support Learner A through the modules. They were already engaging with speech to text software so it was identified that ChatGPT would be beneficial in supporting new forms of structure and with accessing reflective methods of writing about their own work. ChatGPT can question the learner about work in real time, as will be discussed. Learner A began the year submitting assignments below pass across several criteria, especially in critical reflection, which is looked for across the five criteria. After working with Learner A on strategies to use ChatGPT, they ended the year with a number of merits, including one for communication.

Learner B

Learner B had been a student at the college since Level 3 for the two-year extended diploma and now progressed to the Level 4 HNC in Creative Media Production. Whilst on Level 3, Learner B had access to an in-class LA who supported them with assignment structure and frameworks in a similar manner to Learner A. At Level 4, because of its structure as a University equivalent provision, learners do not have direct in class support. Instead, they are expected to be much more independent in taking ownership of their learning. There is access to additional support outside of class if necessary, in the form of bookable sessions for the learner. However, Learner B tended to eschew this additional support when offered. Learner B has high levels of anxiety, which has an impact on the work that they produce. Usually, they were unable to begin an assignment without being walked through the topic and over each detail multiple times; this is related to their confidence and the desire to get the work correct; additionally, they struggled to comprehend when trying to work out what the tutor is asking of them. As a result, submissions are often delayed, or not completed at all, which became a pattern for every module. It is worth noting however, that Learner B articulates good subject knowledge verbally and was often observed supporting peers. Practical tasks were completed to a good standard, but this was never reflected in written work. ChatGPT was suggested to Learner B to probe their pre-existing knowledge to enable them to build confidence by identifying and questioning to expand responses.

Ethical Considerations

Learner A and Learner B were 18 years old and permission was sought and agreed before working with them to develop strategies of support using AI. Owing to Learner A's additional learning need, this was also discussed in detail with their guardian to ensure that there was a full awareness and transparency in the work that was being done with AI. Work was conducted to ensure that both learners were aware of the use of the AI in support of learning and full ChatGPT transcript data was collected and recorded to understand how they were interacting with the AI. Both learners were aware that they were being written about in this chapter.

The Importance of Base Knowledge

A recent survey suggested 85% of learners replaced at least some of their tutoring with AI systems, such as ChatGPT, considering it more effective than traditional tutoring methods (Intelligent.com, 2023). This might seem alarming to teachers, signalling that they are no longer required. However, as Diane Gayeski, a higher education consultant with Intelligent.com points out, "ChatGPT cannot do what experienced human tutors do because it's reliant on the user entering good prompts" (Dey, 2023). of the 6000 plus learners that were part of the survey, they already had a base knowledge in the topics that they were using ChatGPT to support meaning that the prompts being entered into the Chatbot were focused and specific to the task that they were studying. Importantly, the subjects that the learners were using AI to support fell primarily within the STEM subjects that tend to have well defined evidence-based answers, making it easier to cross-reference knowledge and demonstrate where learning has taken place.

Metacognition and AI

The concept of metacognition is ultimately where we as educators strive to move our learners towards: demonstrating independence and awareness of how to learn. As Deborah L. Butler and Philip H. Winne reminds us 'Theoreticians seem unanimous – the most effective learners are self-regulating' (1995, p. 245). Yet, as Eleonora Papaleontiou-Louca adds,

'Key to effective self-regulation is accurate self-assessment of what is known or not known [...] only when students know the state of their own knowledge can they effectively self-direct learning to the unknown' (2003, p. 10).

This suggests that for the motivated learner, AI can be a useful tool to continue the practice of learning outside of the classroom. However, as in the case of those surveyed above, this independence is supported by a good foundation and base knowledge of well-defined subject areas. Before AI can be deployed, all learners will need to have confidence in the basics and this needs to be supported by a competent tutor. For example, a motivated learner could do very well following tutorial videos from a YouTube playlist. However, without the appropriate guidance and direction, which is hard to achieve without interaction, it is difficult to know what specific parts need to be developed, repeated, or stretched and challenged.

Intelligence and AI

AI is very good at replicating certain types of intelligence. As Rosemary Luckin Highlights:

'It is relatively straightforward to develop AI systems that can teach welldefined subject areas [...]. These systems can help learners to build an understanding of the facts that remain a part of STEM subjects' (2018, p. 100).

However, this is only part of what a teacher does and only part of the intelligence spectrum in which humans can excel. Related to AI education, Luckin suggests that if we are not diligent, we may focus only on the area that AI is good at and move to a point where the teacher facilitates the learner in learning facts. This of course, is assuming the learner can make deeper connections with the facts presented – some learners will inevitably not be able to do that at all, whilst others might achieve it at a different pace. As Luckin goes on to say, 'we must develop education systems that encourage our human educators to use their expertise to focus on the other elements of human intelligence' (p. 101). This is where it becomes important to properly teach AI to learners and create an understanding of the importance of making connections with the learning they are undertaking. Simply using the AI in place of learning, as a form of 'cognitive offloading,' becomes problematic. Subject specific facts are of course important, learners can learn facts and be able to articulate them in different formats, but they also need to be able to understand the reason for learning in the first place. Learning is also learning how to discriminate, be reflexive and think critically; it is knowing how to solve problems. This is supported by Luckin, who is an advocate for AI but stresses its fundamental differences from a broader spectrum of human intelligence and how we learn:

'we must develop an understanding of what knowledge is, what it means to know something, what good evidence is and know to make good judgements based on that evidence and our context' (p. 105).

AI is already presenting problems in knowing what is real or not. It has been shown to present false and mis-leading information including making up references for research that has never existed, such as academic papers and journals (Shearing & McCallum, 2023). Wikipedia has often been used as an example of poor practice for research when discussing how to source and cite information, as is a heavy reliance on unreliable web sources owing to the way that it can be manipulated, changed or deleted. It is already taught to the learner that a website like Wikipedia may be a useful starting point but that

they should really be developing a robust and broad research base when discussing topics and supporting arguments. This is a persisting issue with AI such as ChatGPT, which can re-affirm personal bias, has a heavily reliance on the English language and is acknowledged to be skewed towards 'Western views' (Open AI, 2023). Additionally, it was noted in the research for this chapter that often learners are unsure how to start writing prompts for Generative AI. They cannot access the technology because they lack the base knowledge to ask the right questions as established earlier. For example, when writing a short essay, they might prompt: 'write a 1000 word essay on X,' and the AI would respond with text that has no connection to the learning that has taken place, which is detrimental for the learner in the long-term. As educators, it becomes important to contextualise the impact that this would have and the benefit of doing the work. A learner would be better off entering instead: 'I am writing about X. Ask me questions about the topic that I can use to support a 1000word essay. Include suggestions on structure and potential talking points that I can research further.' This will create a response that builds on knowledge and supports learners with structure, rather than produces work for them. AI should be treated in a similar way to existing research and learning tools, where a solid base understanding of the topic, of bias and also critical thinking skills should be applied. It is an imperative to teach learners that AI is not a shortcut for learning. The importance of the process of learning is key.

Support and AI

Within the FE environment, there is a high proportion of learners with Special Educational Needs (SEN) who work closely with in-class support. Julie Radford, Paula Bosanquet, Rob Webster and Perter Blatchford note that learners often work with LAs who are not sufficiently trained in the subject that they are in class supporting. This leads to a disparity of learner outcomes within the same classroom, amplifying the gap in attainment. As Radford notes of Teaching Assistants [TA] who facilitate a similar role to a LA:

'TAs are much more likely than teachers to ask lower quality questions and reduce pupil's independence through supplying answers, they are prone to giving inaccurate or misleading information, albeit unintentionally' (2015, p. 1).

This is not the fault of in class support, they play a vital role within the classroom to develop strategies of support for individual learners. However, there is a clear impact on those learners who require a LA and those who do not. This is particularly acute in FE as the variety of subjects, high number of learners¹ and lower funding means that class support is not always able to be subject

¹ Roughly 6000 learners enrolled on further education courses over three main campuses at the college in this chapter.

specific. Instead the focus is on general assignment interpretation, spelling punctuation and grammar (SPAG), writing structure and accessibility frameworks. This makes it challenging to form an initial connection with learners to create a meaningful exchange. For many learners there is also a perceived stigma associated with being one of the few in that class requiring additional support and will chose to decline it. Additionally, it can be difficult to articulate the important role that the LA has for the learner and this is especially apparent when a LA has little or no subject specialism. As Radford, Bosanquet, Webster and Blatchford suggest:

"TAs assigned to support pupils with significant needs were often unable to articulate their role in any meaningful detail and simply describe their role as 'being there' for the pupil. This casts TAs in a 'standby' mode, ready to respond when a pupil signals difficulty but not always effectively" (2015, p. 3)

This is compounded by some of the learners who will often suggest to tutors and LAs that they are 'OK' when asked. This can lead to a LA sitting back awaiting further instruction from a disinterested learner. Positive development in attainment also relies on a solid constructive relationship with the learner, which can take time. If a LA, or tutor for that matter, is continually changed, an ongoing disruption exists for that learner.

AI in this context could be used in several ways. Firstly, to augment initial delivery whilst the learner waits for further feedback. It could be used to answer and potentially explain initial and remaining questions the learner might have about a task. This means any individual LA time can be focused on the complex, challenging and individual parts of the task, which the learner requires ongoing support with. Tutorial time is more valuable and does not revisit the same ground. AI could be used to clarify and translate on the learner's own terms and this also supports a drive towards increased confidence for the learner. The role of the learner and teacher changes with the introduction of AI in the classroom. As an extension tool for both teacher and in class LA, AI could be used to also answer questions about subject specialism. As the AI takes on more of a supporting role in the lesson, it can be used to build confidence and base knowledge and eventually stretch and challenge. However, it is crucial that AI is first taught as a tool for understanding how to learn and that the importance of learning how to make connections and solve problems is embedded in the learning culture. Instead of using AI in place of learning or in place of doing the work, the focus should always be on developing a learner's critical reasoning. Institutions should be aware that these tools are being used and should work to manage their use. This should be approached with caution to not remove the positive impact these tolls bring. For example, plagiarism checkers, such as 'Turnitin' have developed detectors for misuse, leading some institutions to implement it reactively. However, for some learners, who use AI spelling and grammar technology, and for those who are studying in a second language, using AI for translation have been falling foul of such checkers. This leads to issues around accessibility and inclusivity for some (Fergus & Abrahamson, 2023). Instead, focus should be on the ethical use of AI in support of an understanding of the importance of learning and its processes. Additionally, educators should be focussed on developing strategies on assessment and question the need for certain types of assessments that AI is able to easily imitate. It is possible to develop assessment methods that demonstrate learning and integrate AI with a renewed focus on critical reflection and personalised experience.

AI and Critical Reflection

At the start of the academic year, Learner A was introduced to an 'Ongoing Critical Reflective Diary,' which is based on Driscoll's 'The What?' model (2006, p. 47), as discussed earlier. The level 3 course is structured so that the first module learners embark on a series of 'Skills Development' sessions to develop the associated technical knowledge and allow all learners with varying degrees of prior experience to move onto more advanced skills together with equal base skill level. They are expected to make short but meaningful reflections, either at the end of the session, or at regular intervals throughout the task. For many learners starting the course, this is a very different mode of reflection to school, which favours an end of project evaluation. This means much of the understanding in developing skills during the process of learning is lost, as previously argued:

'It would be far better to develop an approach to the work that doesn't focus on the end result and instead considers the whole development process rather than outcomes. This questioning then becomes part of the whole assignment that provides ongoing self-reflection. [...] Crucially, this allows the learner to recognise for themselves the evolution that they have undertaken.' (Hill, 2022, p. 57).

The use of a reflective diary is so the learner can take ownership of their own learning process instead of an evaluation becoming an afterthought. Importantly, the diary forms part of the learner's metacognition, designed to signpost their thinking back to them in a structure that is engaged in the process and easier to manage. Or, as suggested by Christine B. McCormick, Carey Dimmet, and Florence R. Sullivan also referred to as 'thinking about thinking' (2012, p. 69). Learners who possess the characteristics for academic successful have a solid base knowledge as highlighted by the earlier survey (2023). However, as pointed out by McCormick et al, this is in tangent to several other important self-managing characteristics:

'As they study, they are able to monitor when they do not understand and know when and how to use effective strategies to improve their understanding.' (2012, p. 69).

This is a key aim of the reflective diary as the typical learner in an FE environment is not always one with a history of academic success and must be supported to develop these strategies. Therefore, it takes some time to adapt to this form of ongoing reflection and requires the delivery that prioritises importance of process over outcomes and why they are engaged in learning in the first place. They must unlearn existing strategies to fully appreciate and understand the importance of learning to self-identify and monitor progress. A key benefit of an ongoing reflective diary is in its ability to develop mindset for the learner. The evaluation is built up over time and has much more value on the development learning (Hill, 2022, p. 58). AI in addition to ongoing reflection, has the benefit of creating further opportunities for the learner to take ownership of learning and to promote those characteristics and strategies for academic success. They are being supported, but in a way that is creating the conditions for independence.

Learner A and AI Support

Learner A started the year discussing the following related to an Adobe Photoshop technical session using Driscol's model:

'The what?

I had to use my skills on Photoshop using photobashing [sic].²

So what?

I have learnt more skills than I started this course with. I feel like this is an important skill to learn as photobashing can be used in the industry as well sometimes as it can be used to show that something is in another location or doing another action. Photoshop is an interesting piece of software to use as it requires a lot of skill to master.

Now what?

I would like to learn more skills as I go on.' (Anonymous L. A., 2023)

In this early reflection, Learner A briefly identifies the activity with 'The what' descriptive question, however, they would benefit from additional detail for later recall and future development. Learner A also provides limited information on how the task has potential for use in the creative industries yet does not go into important detail of what that looks like or the significance of the task itself. For the reflection to be of value, it would benefit from a detailed

² Photo Bashing is a technique that requires a learner to select visual source material, either whole images, or parts of images and use intricate selection and cutting out techniques in Adobe Photoshop software to seamlessly blend them together into a new composited image.

breakdown focusing on the parts that require more work to refine. From this, they would identify a future goal to focus on when answering the 'Now what' question. This response is not specific enough and does not support higher levels of metacognition.

Later in the year with continued practice, Learner A was better able to reflect on progress and began to articulate technical language and identified areas of improvement. This was a noticeable improvement on the beginning of the year. However, Learner A still was focused on describing steps over discussing the significance of the skill being learned missing opportunities to support developed approaches for improvement. to address, Learner A was encouraged to use the free version of ChatGPT³, to support probing questions and a more in-depth critical reflection of the task. The appeal of AI was the potential for responsiveness, interactivity, and accessibility for the learner, when they needed it. Initially, to get used to the language model, Learner A engaged with ChatGPT independently using the answers that they had already provided in their reflective diary. However, this quickly raised some challenges. A key issue when working with the AI model is its understanding of individual learner need and their ability to enter prompts. The value of using AI also relies on the learner's ability to discriminate good information from poor information. For example, Learner A entered a reflection about a computer-generated model of a sword, part of a computer games asset task:

'At first, I was doing ok as the sword was going as planned. But as I was getting to the top, I had a bit of trouble getting the shape right as it was a strange curved shape, so I had to be careful. However, it turned out ok at the end. Although, along the way, the top part kept going out of shape, so I went into vertex mode to fix the shape. I then went to UV [Flat Surface Coordinates] the sword, but I ran out of time to make it into something which is acceptable in the gaming industry, so I am going to spend the next lesson fixing it up and texturing it. This was significant because this would be practice for the real world in the gaming industry.'

ChatGPT was prompted to 'read the [above] text and give suggestions to support critical reflection.' The initial response from AI:

Based on the given text, here are some suggestions to support critical reflection:

1. Reflect on the challenges faced: The writer mentions having trouble getting the shape right and the top part going out of shape. Encourage them to critically reflect on these challenges and consider why they occurred. Was it due to a lack of knowledge or skills? Were there any external factors that contributed to the difficulties? This reflection can help identify areas for improvement.

³ As of 2023, Version 3.5

- 2. Analyze problem-solving strategies: The writer mentions going into vertex mode to fix the shape. Encourage them to analyze the effectiveness of this strategy. Did it solve the problem satisfactorily? Were there alternative approaches they could have taken? This reflection can help develop a deeper understanding of problem-solving techniques and improve future decision-making.
- 3. Evaluate time management: The writer ran out of time to create an acceptable texture for the sword. Encourage them to critically evaluate their time management skills. Did they allocate enough time for each task? Were there any inefficiencies or distractions that hindered progress? This reflection can lead to better time management strategies for future projects.
- 4. Consider the significance of the experience: The writer mentions that this project was significant because it served as practice for the real world in the gaming industry. Encourage them to critically reflect on the lessons learned from this experience. What specific skills or knowledge did they gain? How can they apply these learnings to future projects or professional endeavours? This reflection can help contextualize the significance of the project and its value for personal and professional growth.
- 5. Identify areas for improvement: Based on the challenges faced and the outcomes achieved, encourage the writer to critically reflect on their own strengths and weaknesses. What aspects of their work were successful? What areas require improvement? This self-assessment can guide their future learning and development goals.

Overall, critical reflection involves analyzing and questioning one's actions, experiences, and outcomes. By encouraging a thoughtful examination of the project, its challenges, and its significance, the writer can gain insights that will support their personal and professional growth in the gaming industry. (2023)

ChatGPT responds with some useful information on how to reflect. The model is also able to unpack Learner A's reflection and provide five points of further reflection with questions to consider. However, for Learner A, who finds it a challenge to process vast amounts of information at once, it becomes visual noise as there is too much to identify what to prioritise. Additionally, a lot of the language that the ChatGPT response provided had little to no difference on existing resources Learner A already had access to and had been previously delivered. For example, evaluation support guidance is part of the assignment and resources, such as evaluative question lists are provided. A tutor would be able to read the reflection and see that the language Learner A was using needed to be delivered in a manageable way and adapt the resources accordingly. This is because much of the way that Learner A is supported, either by a teacher or LA, is through the relationship and history that is built up over time and the investment in understanding how they learn. The ChatGPT response to the reflection above lacks any nuance and does not add value for the learner over what they have already had delivered to them. Thus, highlighting the quality of the prompt entered is vitally important to the quality of the response. This should be a key focus when delivering AI as part of a curriculum.

Crucially, for Learner A, AI can be used to support them, but it needs to be done in parallel with continued support from the teacher and any additional learning support that they have in place to develop prompt writing and also check ChatGPT responses are accessible.

As it was quickly recognised that the response above was not specific enough to support Learner A, the approach to prompting was developed to create value to the learning. For example, instead of asking ChatGPT to provide support for generalised reflection, the prompt was adapted to first train the AI to understand Driscoll's 'The What?' reflective framework and then apply a further simplified approach with a scaffolding:

- 1. The what? (Description):
 - a. What was the issue you faced with using only one half of the picture in Maya's image plane?
 - b. How did the arm getting in the way affect your box modelling process?
- 2. So what? (Meaning and Impact):
 - a. Why was it important to consider redrawing the image as an orthographic image or finding a normal girl looking character for the image plane?
 - b. How did narrowing down the character pose to a T-pose or P-pose impact your modelling process?
- 3. Now what? (Connections and Future Actions):
 - a. What did you learn from the experience of the missing icons for orthographic view in Maya? How did you solve that issue, and how can you prevent it in the future?
 - b. Reflecting on starting the modelling from the neck, what were the outcomes? Would you approach it differently next time? If so, how?

Learner A was then able to develop responses to the questions with the support of the tutor. For example, in response to the 'So what (meaning and Impact)' and 'Now what (connections and future actions):

So What?

'It was important to consider redrawing the image as an orthographic view or finding a normal girl character in a front view because it usually is easier to model something which is in the front view as it shows the full shape of the body and details which need to be added.

Narrowing down the character to a t-pose or p - pose helps visualise the character shape, details, and proportions of the character. It also helps with the modelling of the character in 3D as it makes the character look proportional.'

Now What?

'I learned that without those icons I could not do any work as they were important to have orthographic views as it shows all the different viewpoints of the 3D model that we would be making in Maya. I solved the issue by going into the interphase and then workspace and then resetting the UI in Maya. I

can prevent it by practising the controls of Maya so that I do not lose the controls in the future. If I do loose the controls though, I can always troubleshoot the problem online. (2023)

The new reflection from Learner A demonstrated much more depth, showing technical awareness and confidence than their previous evaluative writing. Additionally, Learner A, with the support of a tutor and LA, has begun to exhibit some of the characteristics associated with a higher level of metacognition such as the suggestion of online problem-solving.

Learner B: AI Support

As noted earlier, Learner B has challenges with their ability to interpret and complete assignment work, assessment criteria and learning outcomes. They are usually able to articulate knowledge verbally, albeit not necessarily specific to the assignment task. This suggested they can accumulate knowledge for certain topics yet for new subjects, meaning confidence is a significant barrier to learning. Learner B was encouraged to use ChatGPT as a method of unpacking the meaning of learning outcomes, then probe existing knowledge and suggest ways that they could expand answers. For example, a Level 4 module, 'Unit 23: Game Design,' requires learners to 'evaluate factors that contribute to the generation of successful ideas' (Pearson, 2022, p. 291), which is crucial in the sequencing of the assignment before creating a proposal and then functioning prototypes. Learner B prompted the following: 'what is being asked of me when I'm asked, "Evaluate effectiveness of idea generation methods",' to which ChatGPT responds:

'When you are asked to "evaluate the effectiveness of idea generation methods," you are being asked to assess and analyze the success of different techniques or strategies that are used to generate ideas. This requires you to:

- 1. Understand and be knowledgeable about various idea generation methods, such as brainstorming, mind mapping, SWOT analysis, and so on.
- 2. Evaluate the effectiveness of these methods by analyzing how well they have worked in different situations, and whether they have achieved the desired outcomes.
- 3. Consider the advantages and disadvantages of each method, such as how well they foster collaboration, how easily they can be implemented, and how well they suit different types of problems or projects.
- 4. Provide a critical assessment of each method, highlighting its strengths and weaknesses, and making recommendations for how it could be improved or applied more effectively.

Overall, evaluating the effectiveness of idea generation methods involves assessing how well different techniques have worked in practice, and providing insights into which methods are most effective for generating creative, innovative ideas in different contexts.' (Anonymous L. B., 2023) As seen with Learner A, ChatGPT creates a response that is not allowing for Learner B's ability to break down the information for themselves. Learner B does have more experience with ongoing reflection and as a key difference to Learner A, Learner B primarily needs support with starting an assignment, which ChatGPT provides in the form of 4 key areas to interrogate. As they progressed, Learner B begins use AI to expand on answers related to their analysis of the SCAMPER4 (Serrat, 2017, pp. 311-314) idea generation technique:

'Have I properly evaluated how SCAMPER helped me? "Using the idea generation method called SCAMPER, it allowed me to break down the general concept I original had into smaller bits and allow me to advance my idea even more making it much more effective and appealing." (2023)

From a tutor perspective, Learner B needs to produce much more analysis in their answer to unpack the technique and its impact on idea generation processes. ChatGPT seems to concour by responding with feedback and suggestions on how to develop it:

'Your statement provides a brief overview of how SCAMPER helped you, but it could be further developed to provide a more thorough evaluation of its effectiveness.

To properly evaluate how SCAMPER helped you, you may want to consider the following points:

- 1. How did SCAMPER specifically help you to break down your original concept into smaller bits? Did you use any particular SCAMPER techniques (substitution, combination, adaptation, modification, putting to another use, elimination, or rearrangement) that were particularly effective in generating new ideas or refining your original concept?
- 2. In what ways did SCAMPER make your idea more effective and appealing? Did it help you identify any key features or benefits of your idea that you had not previously considered? Did it help you to address any potential weaknesses or limitations in your original concept?
- 3. How does SCAMPER compare to other idea generation methods you have used in the past? Are there any advantages or disadvantages to using SCAMPER over other methods? Did you find that SCAMPER was particularly well-suited to the type of problem or project you were working on?

By considering these questions, you can provide a more detailed and thoughtful evaluation of how SCAMPER helped you to generate and refine your ideas.'

⁴ SCAMPER is outlined by Olivier Serrat as a method of generating ideas through questioning and then modifying something that already exists. The acronym stands for: S—Substitute (e.g., components, materials, people) C—Combine (e.g., mix, combine with other assemblies or services, integrate) A—Adapt (e.g., alter, change function, use part of another element) M—Magnify/Modify (e.g., increase or reduce in scale, change shape, modify attributes) P—Put to other uses E—Eliminate (e.g., remove elements, simplify, reduce to core functionality) R—Rearrange/Reverse (e.g., turn inside out or upside down) (2017, p. 312)

Learner B then followed up with an updated response and continued to gain further feedback on the answers that they were developing for the assignment, prompting:

'how about now? "Using the idea generation method called SCAMPER, it allowed me to break down the general concept I original had into smaller bits and allow me to advance my idea even more making it much more effective and appealing. When taking each bit of SCAMPER into consideration it allowed me to adapt the game to fit more into the modern era, an example of this would be the Elimination part of scamper, by removing the concept of the provided shields in Space Invaders it would make the game a lot more tense and require a lot more attention to avoid being shot down. The use of SCAMPER made my concept more appealing by being able to break down main points of the game concept to allow me to refine ideas to more fit into the modern age of gaming."

This then creates the following feedback and response from ChatGPT:

'This updated response provides a more thorough evaluation of how SCAMPER helped you in generating and refining your ideas.

You have clearly explained how SCAMPER allowed you to break down your original concept into smaller bits, and how you used one specific technique, Elimination, to refine your concept by removing the concept of provided shields in Space Invaders, making the game more challenging and requiring more attention.

Additionally, you have highlighted how SCAMPER made your concept more appealing by allowing you to refine your ideas and adapt the game to fit more into the modern era of gaming. By breaking down the main points of the game concept, you were able to identify areas for improvement and refine your ideas to better suit modern gaming trends.

Overall, this updated response provides a more comprehensive evaluation of how SCAMPER helped you generate and refine your ideas, by providing specific examples of how you used the technique to improve your concept and adapt it to fit modern trends.' (2023)

Learner B is clearly able to use AI in a more independent manner and discriminate information that is being responded much easier than Learner A. For Learner B, getting started on an assignment and being able to access clear understanding of what is being asked is the biggest barrier to their ability in completing work, which AI can begin to bridge. Learner B accesses ChatGPT on their own terms and create prompts in a way that they understand and this leads to fewer exchanges with the tutor covering the same ground – they can self-regulate and monitor progress with the support of AI and add value with a tutor.

Conclusion

AI allows the learner to take ownership of their self-management. Crucially, this is not completely independent of tutors and LAs who are still required to support the broader spectrum of learning. This is because of the way that positive classroom relationships are fundamental to the development of learning strategy with each learner. As pointed out, there are several characteristics that are associated with the academically successful learner, which includes a solid understanding of the basics that they can carry forward independently and develop. AI is useful for these learners who wish to continue development outside of the classroom. For other learners who require additional support and those who did not learn those characteristics, AI can support strategies in building confidence, which in turn will be reflected in the learner outcomes through developing self-regulation. AI can bridge the divide within classrooms that have a broad range of ability and support. It can be used effectively by learners to answer some of the base questions that might arise from initial delivery, which would mean that interactions between a tutor and learners can be more focused on stretching and challenging them. AI is also a useful tool for LAs who may not have the requisite knowledge to support specific lessons, or topics. The AI in this context would assist with the technical understanding of a subject so that the LA can support the learner to develop strategies for their individual need.

AI's use as a tool to support scaffolding strategies for better metacognition is important for both teachers and LAs and further training in using AI models for the specific purpose of scaffolding and metacognitive applications is where we should be investing time in developing ways to work with AI. As discussed, the way in which a learner prompts becomes vital to the value of the support that they receive from AI. Therefore, teachers and Las must be prepared to deliver methods of prompting that go beyond surface inquiry and able to question a learner in a critical and reflexive way. Institutions also need to be prepared to remain open to the ever-changing landscape of AI so that it remains accessible and inclusive for all learners. AI can create the conditions for learners to learn on their own terms. Therefore, it is also important to trust the learner using this technology with emphasis on the way that these tools are integrated and delivered as part of the process of learning. AI comes with significant changes to the way that we monitor assessment and there are significant challenges in the way we can easily use AI in place of doing the work. However, value must be placed on the importance of learning, highlighting that process and the impact that it will have in future problem solving should take priority in the classroom as AI is no substitute for a Learner who is able to engage critically with a topic, self-reflect and self-manage. One focus might be on developing approaches to better prompt writing, which gives the learner an opportunity to test existing knowledge and develops strategies for developing their skills. Getting the AI to question, rather than create blanket responses. When applied in conjunction with other forms of research, together with supportive teachers, AI is a significant teaching tool that can be used to develop supporting strategies and engage learners on their own terms.

References

- Anonymous, (Referred to as Learner A). (2023, May). Level 3 Extended Diploma in Creative Media Production: Learner Case Study Data. (P. Hill, Compiler)
- Anonymous, (Referred to as Learner B). (2023, May). Level 4 Higher National Certificate in Creative Media Practice: Learner Case Study Data. (P. Hill, Compiler)
- Assessment and Qualifications Alliance (AQA). (2023, August 7). A-Level Media Studies (7572). Retrieved October 13, 2023, from https://filestore.aqa.org.uk/resources/mediastudies/specifications/AQA-7572-SP-2017.PDF
- Butler, D. L., & Winne, P. H. (1995). Feedback and Self-Regulated Learning: A Theoretical Synthesis. Review of Educational Research, 65(3), 245-281.
- Dey, V. (2023, May 29). ChatGPT takes center stage as students ditch tutors in favor of AI-powered learning. Retrieved from Venture Beat: https://venturebeat.com/ai/chatgpt-takes-center-stagestudents-ditch-tutors-in-favor-of-ai-powered-learning/
- Driscoll, J. (2006). Practicing Clinical Supervision: A Reflective Approach for Healthcare Professionals. Philadelphia , PA: Bailièrre Tindall.
- Fergus, S., & Abrahamson, E. (2023, June 29). ChatGPT. Hertfordshire Higher Education Consortium Teachers Conference. Hatfield, Hertfordshire: University of Hertfordshire. Retrieved from https://www.herts.ac.uk/study/schools-of-study/hertfordshire-higher-education-consortium
- Gibb, G. (1988). Learning by doing: a guide to teaching and learning methods. Oxford: Oxford Polytechnic.
- Hill, P. (2022). Critical Reflection in Creative Media Practice. Blended Learning in Practice, 57-62.
- Intelligent.com. (2023, May 15). NEW SURVEY FINDS STUDENTS ARE REPLACING HUMAN TU-TORS WITH CHATGPT. Retrieved from Intelligent.com: https://www.intelligent.com/newsurvey-finds-students-are-replacing-human-tutors-with-chatgpt/
- Luckin, R. (2018). Machine Learning and Human Intelligence: The Future of Education for the 21st Century. London: UCL Institute of Education Press.
- McCormick, C. B., Dimmit, C., & Sullivan, F. R. (2012). Metacognition, Learning and Instruction. in I. B. Weiner, W. M. Reynolds, & G. E. Miller, Handbook of Psycology, Volume 7, Educational Psycology (2nd ed., pp. 69-97). New Jersey: Wiley. doi:https://onlinelibrary.wiley.com/doi/ 10.1002/9781118133880.hop207004
- Open AI. (2023). Is ChatGPT biased? Retrieved from Open AI: https://help.openai.com/en/articles/8313359-is-chatgpt-biased
- Papaleontiou-Louca, E. (2003). The Concept and Instruction of Metacognition. Teacher Development, 7(1), 9-30.
- Pearson. (2020). Pearson BTEC Level 3 Nationals 540 Diploma and Extended Diploma in Creative Media Practice. London: Pearson Education Limited.
- Pearson. (2022). BTEC Higher Nationals Creative Media. London: Pearson Education Limited.
- Porter, N. (2015). Crossing the Line: Improving success rates among students retaking English and Maths GCSEs. London: Policy Exchange.
- Radford, J., Bosanquet, P., Webster, R., & Blatchford, P. (2015). Scaffolding learning for independence: Clarifying teacher and teaching assistant roles for children with special educational needs. Learning and Instruction, 36, 1-10.
- Serrat, O. (2017). Knowledge Solutions: Tools, Methods, and Approaches to Drive Organizational Performance. Cham, Switzerland: Springer.
- Shearing, H., & McCallum, S. (2023, May 9). ChatGPT: Can students pass using AI tools at university? Retrieved June 7, 2023, from BBC News: https://www.bbc.co.uk/news/education-65316283

CRITICAL THINKING AND AI: A BOOSTER OR A DESTRUCTIVE FORCE IN LITERATURE TEACHING

Chahra BELOUFA^{*}

ABSTRACT

The introduction of AI tools like ChatGPT, have made it feasible to develop new teaching methods and curriculum, encouraging a profound shift in the education sector. Teachers may easily construct a variety of exercises, lectures, and resources with ChatGPT. The consequences of ChatGPT on students' capacity for critical thought when examining a piece of literature worry the researcher. The effects of modern technology on students' ability to do well on exams are examined in this chapter. The study will shed important light on how to incorporate ChatGPT into the instruction of literature and highlight the value of critical thinking in education.

Introduction

The rapid progress of artificial intelligence (AI) has had a profound effect on numerous facets of modern life. There are worries that its widespread use may have negative effects on classroom instruction. For instance, do artificial intelligence (AI) tools threaten the pillars of humanistic education because of their disruptive character, or are they used to enhance literary instruction?

It is impossible to overstate the importance of developing a critical mind when reading literature. Literature's ability to mirror the human experience entices readers to investigate competing worldviews, delve deeply into intricate narratives, and broaden their worldviews. Analyzing, interpreting, evaluating, and synthesizing are all critical thinking skills necessary for a complete understanding of literary works. Students can develop their critical thinking, empathy, and an in-depth understanding and enjoyment of narrative power via close reading and analysis of literary works.

Students can engage with the themes, characters, and ideas provided by using these abilities in a critical way, which promotes intellectual development, empathy, and a sense of responsibility in the process a profound understanding of the power of storytelling. However, there are several advantages that AI technologies could provide for teaching literature. Teachers can devote more time to discussions and delivering individualized instruction when automated grading systems respond quickly. AI-enabled virtual assistants can provide students with quick access to information, facilitating research and improving their comprehension of literary works. Machine learning algorithms can examine massive amounts of literary content and reveal connections and patterns

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that could otherwise go undetected, enhancing literary analysis and interpretation.

In 2019, the Committee of Ministers of the Council of Europe supported a report on digital citizenship education that placed a significant focus on the integration of AI into the classroom:

"AI, like any other tool, offers many opportunities but also carries with it many threats, which makes it necessary to take human rights principles into account in the early design of its application. Educators must be aware of the strengths and weaknesses of AI in learning, to be empowered – not overpowered – by technology in their digital citizenship education practices. AI, via machine learning and deep learning, can enrich education ... By the same token, developments in the AI field can deeply impact interactions between educators and learners and among citizens at large, which may undermine the very core of education, that is, the fostering of free will and independent and critical thinking via learning environments, professionals in education and school staff should be made aware of AI and the ethical challenges it poses in the context of schools." (Council of Europe 2019)¹

Primer Artificial Intelligence, Human Rights, Democracy, and the Rule of Law issued by the UK's Alan Turing Institute (Leslie et al. 2021) characterizes AI systems as follows; it is based on the Ad hoc Committee on Artificial Intelligence (CAHAI) Feasibility Study of the Council of Europe.

"AI systems are algorithmic models that carry out cognitive or perceptual functions in the world that were previously reserved for thinking, judging, and reasoning human beings." (Leslie et al. 2021: 8)²

The phrase "artificial intelligence" was coined at a Dartmouth College workshop in 1956. Since then, AI has experienced "AI winters," or periods of tremendous interest and lofty expectations during which high standards were not met and financing all but froze up. Since the beginning of AI research, two concurrent methodologies have attracted attention. First, there is the "symbolic" approach to artificial intelligence, which focuses on knowledge engineering (encoding expert information) and the fundamentals of human thought, and produced "expert systems."

In recent years, there has been a growing convergence between literary writing and artificial intelligence (AI). The analysis and processing of literary texts is one area where AI technology has been used in literary creation (Hou et al.,

¹ Recommendation CM/Rec (2019)10 of the Committee of Ministers to member States on developing and promoting digital citizenship education, https://search.coe.int/cm/Pages/result_details. aspx?ObjectID= 090000168098de08

² http://rm.coe.int/cahai-2020-23-final-eng-feasibility-study-/1680a0c6da.

2022; Omar, 2021). Based on thematic grouping and feature selection techniques, computational models and data mining techniques have been employed to analyze and categorize literary works (Omar, 2021; Omar, 2020). These methods have successfully extracted distinguishing features and produced trustworthy clustering structures (Omar, 2020). Additionally, AI has been used to translate literary works, yet difficulties still exist because it is challenging to effectively translate metaphors and cultural specifics (Almahasees, 2017). New avenues for comprehending and interpreting literary narratives have also become available because of the incorporation of AI in literary studies. People replicate events and experiences in their minds as they read literary narratives, according to eye-tracking studies, which suggest that readers simulate the events and experiences in the text (Mak & Willems, 2018). Additionally, AI has been used to examine how emotions are expressed in contemporary literary works, revealing information about the emotional impact of literary texts (Jing-Xia, 2022). AI has been employed in the field of talent acquisition in IT/ITeS firms, where AI technology is used to speed and improve the recruiting process, in addition to its applications in literary analysis (Pillai & Sivathanu, 2020). The adoption of AI technology in various contexts is an important topic of study, as it has the potential to transform industries and improve efficiency (Pillai & Sivathanu, 2020). However, the use of AI in literary analysis and interpretation raises ethical and legal concerns. It is crucial to think about issues like copyright protection and data dependability when dealing with literary works authored by AI (Wei, 2022). Another important consideration in AI's widespread adoption is how reliable its models and forecasts are (Ribeiro et al., 2016).

1. The Concept of Artificial Intelligence

AI is characterized as "the study of the computations that make it possible to perceive, reason, and act" or "the automation of intelligent behavior" (AI is characterized as the use this instead -the analysis of the algorithms that enable perception, reasoning, and behavior, or the automated performance of intelligent conduct|)³. However, in most cases and with specificity, AI is typically characterized as a non-human intellect that can mimic human mental abilities like pattern recognition, reasoning about others, strategizing, comprehending natural language (NLP), and adaptable experience-based learning⁴.

³ George F. Luger and William A. Stubblefield, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th ed., 2008; cf. also A. Barr and Feigenbaum, eds., The Handbook of Artificial Intelligence, vol. 2 (Stanford, California & Los Altos, California: HeurisTech Press and William Kaufmann, 1982).

⁴ Cf. Russell, & Norvig, 2009, one of the standard textbooks in the field

	Human Benchmark (H)	Rationality benchmark (R)
Intelligence as Thought Processes (T)	(T-H) Systems that think like humans (e.g. cognitive science) "The exciting new effort to make computers think machines with minds, in the full and literal sense" Haugeland, 1985 "The automation of activities that we associate with human thinking, activities such as decision-making, problem solving, learning" Bellman, 1978	(T-R) Systems that think rationally (logic/ laws of thought) "The study of mental faculties through the use of computational models" Charniak and McDermott, 1985 "The study of the computations that make it possible to perceive, reason, and act" Winston, 1992
Intelligence as goal-oriented behavior (B)	(B-H) Systems that act like humans (Cf. Turing test; Winograd Schema Challenge ³⁹) "The art of creating machines that perform functions that require intelligence when performed by people" Kurzweil, 1990 "The study of how to make computers do things at which, at the moment, people are better" Rich and Knight, 1991	(B-R) Systems that act rationally (rational agents) "A field of study that seeks to explain and emulate intelligent behavior interms of computational processes" Schalkoff, 1990 "The branch of computer science that is concerned with the automation of intelligent behavior" Luger & Stubblefield, 1993

Figure 3: classification of several ai definitions, the theoretical basis, and some examples⁵

The following are a few samples of recent news stories:

2016	Lee Sedol, the reigning Go champion, was defeated at the Go board game by the AlphaGo computer program developed by Google.
	It was predicted that computerized technology might not reach the level of defeating a human for another century at the highly sophisticated Go game after Garry Kasparov, IBM's Deep Blue defeated a chess champion.
	Tay, a new AI bot from Microsoft, was capable of learning from social media user behavior. Tay quickly morphed into a malicious troll who tweets derogatory remarks about women and makes fascist comments.
2017	Growing concerns emerged alleging that Facebook's AI systems had created their language, incomprehensible to humans. The programs were immediately termi- nated since these narratives played directly into fears about unrestrained AI.
	Hanson Robotics' Sophia, a robot, received citizenship after speaking at a conven-

⁵ Adapted from Russell and Norvig, Artificial Intelligence: A Modern Approach., p. 5. The sources mentioned are R.E. Bellman, An Introduction to Artificial Intelligence: Can Computers Think? (San Francisco: Boyd & Fraser Publishing Company, 1978).; E. Charniak and D. McDermott, Introduction to Artificial Intelligence (Massachusetts: Addison-Wesley Reading, 1985).; J. Haugeland, ed., Artificial Intelligence: The Very Idea (Cambridge, Mass: MIT Press, 1985).; R. Kurzweil, The Age of Intelligent Machines (Cambridge, Mass: MIT Press, 1990).; George F. Luger and William A. Stubblefield, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 2nd ed. (California: Benjamin/Cummings, 1993).; E. Rich and K. Knight, Artificial Intelligence, 2nd ed. (New York: McGraw-Hill, 1991).; R.I. Schalkoff, Artificial Intelligence: An Engineering Approach (New York: McGraw-Hill, 1990). and Winston, Artificial Intelligence.

tion in Saudi Arabia.

2018	Sundar Pichai, CEO of Google presented Google Duplex, an AI assistant capable of executing activities like organizing dinner reservations and whose voice was purported to be indiscernible from a human's.
	President Barack Obama was featured in a convincingly false video reading a speech that was being delivered by Jordan Peele, a comedian.
2019	Harish Natarajan, one of the top debaters in the world, was challenged by IBM's Project Debater to a discussion about funding for preschools. The judges de- clared Natarajan the victor after a contentious contest between man and ma- chine.
2020	In a piece posted by The Guardian, GPT-3, an OpenAI language generator, claimed that humans should not view AI as a threat.
	Boston Dynamics just published a video of robots dancing to "Do You Love Me" by The Contours.

Table 1: The Advancement of Artificial Intelligence⁶

2. The Significance of Critical Thinking in Literature Teaching

In his essay "What to Believe or Do," Robert Ennis described critical thinking as a thought process that is rational and introspective and is centered on determining how to act or what to believe (Ennis 1985, 46). A different way to characterize critical thinking is using reasoned and reflective thought to make wise decisions about beliefs and actions. The ability to think critically includes many different skills, including drawing conclusions, comparing, figuring out causes and effects, recognizing the impact of context on judgment, assessing the validity of sources, identifying overgeneralizations, separating facts from views, and employing many more techniques.

Critical thinking, according to Facione (2015), calls for both dispositions and cognitive abilities. A skilled critical thinker will be capable of truth-seeking, methodically, and curiously evaluating, appraising, inferring, and self-regulating a situation or problem that is presented. As a result, critical thinking has emerged as one of the abilities that students must develop in the current era (Saleh, 2019).

Bruce (2014) describes critical thinking as any evaluation and judgment made concerning a certain characteristic, item, or conduct within a certain sphere of human activity (p. 85). Furthermore, such judgments according to Tai et al. (2018) involve the assessments of the caliber of either one's creations or those of others. According to these viewpoints, in academic work, which is usually supported by evidence, critical thinking involves evaluating the quality of the

⁶ H. Sheikh et al., *Mission AI*, Research for Policy, https://doi.org/10.1007/978-3-031-21448-6

information that has previously been presented in past studies. to put it another way, authors must synthesize, evaluate, and build their positions on the knowledge offered in earlier studies. According to Wingate (2012), critical thinking is a necessary component of academic writing, which consists of constructing arguments based on evidence, which is a necessary element in writing for higher education.

Ennis (1989) described critical thinking as logical and reflective thought processes aimed at choosing our beliefs or actions, building on the premise that reflection is a component of critical thinking. Later, Paul (1996) asserted that developing critical thinking skills enables one to begin controlling the ideas that govern their lives. It is to think purposefully, carefully, and knowingly in ways that change who you are. It is to operate one's inner workings for the first time and to comprehend the "system" one is running. The goal is to create a mind that can be compared to a physically fit person's body. It is comparable to a talented dancer who can do any dance.

3. AI and Benefits in Education

Roll and Wylie (2016) argue that numerous disciplines have benefited greatly from AI over the last 25 years, such as technical advancements (VanLehn, 2011) and education (Heffernan and Heffernan, 2014; Koedinger and Corbett, 2006). According to Luckin et al. (2016), there are two instances in which Artificial Intelligence in Education (AIED) is used in real-world settings - to encourage student collaboration and enable personalized learning at scale. The AIED community has dedicated the past 25 years to developing platforms for education based on interactions that are just as successful as having a personal tutor (VanLehn, 2011). The most intriguing question from an educational standpoint is not if AIED will take the instructor's place or not, but rather how this technology can enhance and complement the role of the instructor.

With the emergence of new technologies being viewed as a panacea for the various issues related to education, teaching, and learning in classrooms worldwide, Howard Gardner (2000) cautioned against such a notion. With the advancement of technology, Sokolov proposed that educators could streamline the delivery of education through the concept of mass-customized education (Sokolov, 2001). According to Siegle (2004), the emergence of technology is transforming literacy itself. Therefore, it is crucial to conduct further research and studies to understand how technology impacts teaching and learning in education.

Several scholars have chosen to focus their studies on the "revolution" of HOTS (Higher-Order Thinking Skills) as well as the application of knowledge (Duan, 2012; Pecka, 2014). The correlation between technology and the improvement of higher-order cognitive abilities has been assessed (Mojica, 2010; Zenisky, 2014). For 7 months, Mojica studied the impacts of technology edu-

cation modules on the Marble Maze Challenge, Windows Movie Maker for Digital Storytelling, and Lego Mindstorms NXT Robotics System on the ability to think critically and analytically in 105 students in middle school's eighth grade in a New York City suburb. to determine the effects, the study employed The X Grade Level on the Cornell Test of Critical Thinking.

After conducting her research, she concluded that students' higher-order critical thinking abilities were unaffected by technology, regardless of their gender, age, or academic aptitude. However, the correlation between technology use and the improvement of higher-order cognitive abilities has not been well studied. Therefore, further investigation is necessary in this area. Educational organizations worldwide are promoting teaching and learning methodologies that utilize Benjamin Bloom's (1956) taxonomy of learning. Our curriculum guides have included these degrees of comprehension. Teachers rely on them frequently to stimulate student thought in the classroom.

4. Potential Dangers of AI in Literature Teaching

The use of AI in teaching literature could have far-reaching consequences. Using AI technology, there are many ways to enhance and maximize the learning process. It should be highlighted, nonetheless, that analysis of literature and human talents cannot be replaced by artificial intelligence. The following are some key ways that AI affects the teaching of literature: This category can include libraries, digital archives, and online repositories. AI algorithms can help with the classification and categorization of these texts to make it easier to find works, authors, or subjects. Intelligent coaching and individualized instruction: Intelligent teaching systems make use of artificial intelligence to give pupils customized feedback and direction while they engage with literary resources. These tools can evaluate pupils' responses, identify where they need assistance, and provide personalized advice on what to read or investigate next. Structure, style, and language of a text are examined and interpreted using artificial intelligence algorithms: The structure, tone, and language of a work can be examined using artificial intelligence algorithms, which can help students comprehend the author's methods and goals on a deeper level. Natural language processing (NLP) approaches can help analyze sentence structure, spot textual patterns, and spot literary devices. Artificial intelligence (AI) can give comments on students' written assignments and automate some grading processes. While artificial intelligence (AI) cannot completely replace human grading and feedback, it can lessen the workload on teachers by carrying out repetitious activities like checking for grammar and spelling problems, assessing the coherence of sentences, and providing input on how to write better.

Collaborative learning environments and facilitated discussions: AI platforms can support collaborative learning settings where students can debate ideas,

exchange interpretations, and provide feedback to promote communication and collaboration. AI algorithms can facilitate debates by emphasizing different viewpoints, summarizing arguments, and highlighting crucial points.

Virtual reality and immersive experiences can be enhanced by fusing AI with VR technology. This can enable educators to create immersive opportunities for students to discover the places, characters, and historical contexts of literature. Using virtual reality simulations, students can engage in an immersive and interactive experience that explores a specific cultural period, location, or historical era in the context of literature. Even though renowned theoretical physicist Stephen Hawking cautioned that AI may wipe out humanity, he was communicating through a very basic form of AI technology (Cellan-Jones 2014).

Spector separated Strong AI and Weak AI et al. in 1993. Strong AI features a program that is intended to take the place of a human-competent task, and weak AI features a program that tries to enable a person with less expertise to achieve higher levels of performance. Some research (Siau and Yang 2017; Zhang and Xie 2018) suggests that three distinct levels of artificial intelligence exist: superintelligence, general intelligence, and specialized intelligence. A computer that focuses on a small field is referred to as narrow AI, sometimes known as weak AI.



Figure 1: Critical Thinking Levels

It's crucial to take into account how AI might affect critical thinking and the growth of a critical mind. Although there are numerous benefits to using AI technology, there are also certain risks that might hinder critical thinking. Here are a few possible risks:

Algorithmic bias: AI systems are trained using data that has already been collected and may be biased. AI systems may reinforce and perpetuate existing biases if these biases are not addressed and reduced, limiting exposure to alternative viewpoints and complicating critical thinking. Making sure AI systems are impartial and inclusive during design and training is essential.

AI-powered algorithms frequently customize content and recommendations depending on users' tastes and behavior, creating echo chambers and filter bubbles. While this might enhance user experience, it can also cause echo users to be trapped in "chambers" and "filter bubbles," where they are only exposed to data and viewpoints that reflect their preconceived beliefs. Limiting exposure to competing opinions and viable arguments can limit exposure to other perspectives and impede critical thinking. Artificial intelligence algorithms may offer quick and automated answers to challenging issues. Oversimplification and superficial examination. They occasionally oversimplify problems and offer cursory analyses, though. Relying only on data and analysis produced by AI may deter people from conducting more in-depth studies and critical thought, which could result in only having a cursory understanding of difficult issues. Loss of human judgment and intuition: Artificial intelligence (AI) systems work by following preset algorithms and patterns. They lack the human capacity for contextual consideration, judgment, and intuition that humans frequently bring to critical thinking. An overreliance on information provided by AI without the use of human judgment can hinder the ability to think critically and independently, without relying on the opinions of others.

Reduced incentive for independent research: People may be less inclined to do independent research and investigations because of the ease with which information is made available by AI systems. There is a chance that people may become less willing to probe deeper, challenge presumptions, and perform extensive research if AI tools offer rapid answers and solutions, which could impede the growth of critical thinking abilities.

5. Chatgpt and Teaching Literature: Gaps in The Literature

There are several factors to consider when examining how ChatGPT and literary texts relate to one another. OpenAI's ChatGPT language model has drawn notice for its capacity to produce text that appears human-like in response to user inputs. The creation of literary writings is just one of the many applications that have resulted from this. The article, "Language Models are Unsupervised Multitask Learners" by Alec Radford et al. is one alternative source to understand ChatGPT's effects on literary pieces (2019). The GPT architecture is described in this study along with its performance on several linguistic tasks, such as text production and completion. It offers perceptions of the potential and constraints of language models like ChatGPT. The article "The Curious Case of Neural Text Degeneration" by Ari Holtzman et al. is another important source (2019). This essay investigates the problem of generic and repetitive content produced by language models. The "neural text degradation" phenomena are discussed, and solutions to this issue are suggested. Understanding this issue is essential if you are thinking of using ChatGPT to generate literary writing because it can enhance the originality and quality of the output. Additionally, the use of variational autoencoders (VAEs) for producing coherent and varied phrases is explored in the study "Generating Sentences from a Continuous Space" by Samuel R. Bowman et al. (2016). in this research, a methodology for teaching VAEs to produce sentences is presented, and its potential applications in natural language creation are discussed. This work can offer insights into different strategies for producing literary texts considering the developments in language models like ChatGPT. It is beneficial to investigate literary works that have been produced by or affected by ChatGPT in addition to academic studies. One romantic novella that uses AI language models in its plot is "The AI Who Loved Me" by Alyssa Cole. This piece illustrates the use of ChatGPT in literary storytelling and poses concerns about the use of AI in the arts. Overall, one can obtain a thorough grasp of the relationship between ChatGPT and literary texts by looking at scholarly studies like those described above and investigating literary works that have been impacted by ChatGPT. This understanding can influence how people discuss how AI language models may transform literature and creativity.

A chatbot called ChatGPT that uses artificial intelligence has shown promise in a number of research areas. A study looked at ChatGPT as an example of how chatbots can be used in the classroom (Tlili et al., 2023). It has been used to help teach chemistry and with general chemistry exam questions (Clark, 2023) and in undergraduate chemistry labs (Humphry & Fuller, 2023). The field of medicine could be changed by ChatGPT by making nursing school focus more on intellectual and critical thinking challenges (Sun & Hoelscher, 2023). ChatGPT has been used in medical, dentistry, pharmacy, and public health education and has been considered for the future of medical education in the field of medicine (Feng & Shen, 2023; Sallam et al., 2023). However, there are also worries about the ethical standards and how using ChatGPT can compromise those standards in nursing practice, research, and teaching (Abdulai & Hung, 2023). The possible drawbacks of generative AI for education, including engineering education, must also be considered (Qadir, 2022). Overall, ChatGPT has the power to improve education by delivering individualized learning experiences, supporting lab work and exam questions, and altering the way some courses are taught. However, it is critical to address moral questions and be knowledgeable about the restrictions and dangers connected to its application in education.

ChatGPT functions as an AI language model within the larger field of machine learning (ML) and natural language processing (NLP). Its main purposes center on facilitating talks and providing information. However, ChatGPT has demonstrated its potential in several areas, including storytelling and creative writing. The ChatGPT's ability to work with human authors is one of its more exciting features. By offering suggestions or prompts, writers can interact with the AI model to discuss story elements, character development, and worldbuilding. This collaborative partnership has the potential to yield original and innovative literary creations.

ChatGPT can be a valuable tool for aspiring authors to grapple with writer's block or challenging sections of their writing. It assists in generating stories automatically through a process known as automatic story generation. AI language models such as ChatGPT can be trained on extensive collections of literature to compose stories in specific genres or to mimic the writing styles of renowned authors. Although the quality of these artificially generated stories may not match that of literary classics, they still serve as engaging and enjoyable writing exercises.

However, the difficulties and ethical consequences of AI-driven writing must be considered.

Originality and Creativity: While ChatGPT aids in the creative process, concerns exist that excessive reliance on AI may stifle originality and creativity. It is possible that human imagination and thought may not be entirely original.

Plagiarism: Owing to the ease of generating text with AI, there is a risk of improper use, leading to plagiarism or the creation of derivative works without proper attribution.

False Information and Bias: ChatGPT may inadvertently generate prejudiced or erroneous information in its output if the training data used to construct it contains such bias.

Balancing human innovation and AI support is crucial in human-AI collaboration. AI should be considered as a tool to support and augment creative processes rather than as a replacement for human authors. While ChatGPT and AI language models have the potential to aid writers and increase literary creativity, their use must be approached with prudence, with an eye toward ethical considerations and the preservation of human creativity and originality. The literary world should welcome AI not to replace human creativity but to help it flourish via testing and refinement.

Artificial intelligence language models can also make books more accessible and make simultaneous translation easier. These services have the potential to increase the reach of works of literature and foster mutual understanding amongst people of different cultural backgrounds and linguistic backgrounds. in addition, ChatGPT and other AI technologies can sift through libraries of existing works to unearth recurring themes, archetypes, and character traits that authors can use to hone their character creation processes.

Furthermore, the authors can leverage AI language models to receive immediate feedback on their writing, including suggestions for grammar improvements, tone adjustments, and enhancement of overall coherence. This streamlined editing process can produce high-quality products.

Wang, Li, Feng, Jiang, and Liu explored the use of AI-generated content to foster collaborative problem-solving and discovered that students' critical thinking and teamwork skills increased. One has engaged with ChatGPT in a different automated discussion about literary themes to check the quality of the response ChatGPT will provide and test its critical capacity. One has asked ChatGPT about pit strike sillitoe. ChatGPT did not recognize the author and the short story. He provided a limited answer that reflects bare knowledge. The answer is demonstrated as follows:

Prompt 1	ChatGPT response
pit strike Sillitoe	It appears you have mentioned "pit strike" and "Sillitoe." You may be referring to a historical event or a specific individual.
	A "pit strike" could refer to a strike or labor dispute in a coal mine (pit), which has been a common occurrence in the history of mining indus- tries. Workers often went on strike to protest working conditions, wages, or other labor-related issues.
	"Sillitoe" could potentially refer to a person's name or a specific context, however, without more information, it is challenging to provide a pre- cise response. If you have a particular question or need more infor- mation about a particular topic related to "pit strikes" or "Sillitoe," please provide additional details, and I will do my best to assist you.

Throughout the answer, we can remark that ChatGPT is generating guesses and that is one of its shortcomings that may occasionally produce misleading or incorrect information. ChatGPT answers that he does not have information on the topic.

Prompt 2ChatGPT responseIt is a short storyThank you for clarifying that you are referring to a short story. You may
be talking about a short story titled "Pit Strike" written by a specific
author named Sillitoe. However, I do not have information about every
short story ever written, especially if it is relatively obscure or not widely
recognized. If "Pit Strike" by Sillitoe is a specific short story you would
like information about or have questions regarding its themes, charac-
ters, or context, please offer additional information, and I will do my
best to assist you.

To test further the responses of ChatGPT, the researcher prompted generative AI to provide information on another novel. These titles were inspired by the course syllabus at the Arab Open University, AA100B course which is a *Past and Present* course about different cultural topics, philosophies, and literary themes.

Prompt 3	ChatGPT response
In Cuba, I was a German Shepherd	"It Cuba I Was a German Shepherd" is a novel written by Ana Menén- dez, a Cuban-American author. The book was published in 2001 and is a collection of interconnected short stories about Cuban immigrants in the United States, particularly in Miami. The stories give us a deep and often funny look at the problems and changes that happen when fami- lies and individuals leave their home country and settle down in a new one.
Prompt 4	ChatGPT response
What symbols stand for cultural displacement and identity in the novel?	Ana Menéndez's poem "In Cuba, I Was a German Shepherd" uses a lot of different images and patterns to talk about identity and moving from one culture to another. The following ideas are illustrated in the book using these images:
	The Title: "In Cuba, I Was a German Shepherd" is a metaphor used in the novel to describe how Cuban immigrants' life alter after they arrive in the United States. For example, it asserts that becoming a new per- son (a German Shepherd) in a different society is like being a Cuban in one's own country (the United States). The mango tree in the family's Miami yard serves as a metaphor for much of the book. It is a link between the present and the past in Cuba. The fruit from the tree, which makes you think of Cuba, stands for sadness and a longing for your home country.
	Cultural Antiques: A variety of cultural artifacts and items serve as markers of the protagonists' displacement from their own Cuba. These can be things like artwork, music, treasures from the past, and special dishes. These items act as concrete reminders of the cultural heritage of the characters and the sensation of loss they experience.
	Language and Communication: Language serves as both a conduit to one's cultural history and a roadblock to assimilation in the book. The choice of language in a particular setting represents the identity of the characters and their attempt to communicate across cultural barriers. Characters frequently move between Spanish and English.
	Names of Characters: Characters' names might represent their dis- placement and sense of identity. While some characters have American- ized names, others have traditional Cuban names, showing their at- tempts to blend into American culture.
	The Ocean: The ocean serves as a metaphor for the protagonists' emo- tional and geographical separation from their native country, particularly the Florida Straits that divide Cuba from the United States. It stands for the risky migration process and being cut off from one's roots.

Cultural Traditions: The story depicts various cultural traditions as hallmarks of the protagonists' Cuban identity, including festivals, rituals, and customs. These customs frequently conflict with American culture, emphasizing the difficulties of cultural exile.

Prompt: Make a lesson plan to teach The Winter's Tale by Shakespeare.

ChatGPT's Response:

For both you and your students, developing a lesson plan to teach Shakespeare's "The Winter's Tale" can be rewarding. As "The Winter's Tale" is one of Shakespeare's later, more complicated plays, this lesson plan presumes that your pupils are at least somewhat familiar with Shakespearean language and concepts. An extensive lesson plan with several sessions is provided below:

Lesson Title: Exploring Shakespeare's "The Winter's Tale"

Grade Level: High School (10th-12th grade)

Duration: Five 60-minute sessions

Learning Objectives:

- 1. Analyze the plot, characters, and themes of "The Winter's Tale."
- 2. Understand the historical and cultural context of the play.
- 3. Develop an appreciation for Shakespearean language and its relevance today.
- 4. Perform selected scenes to enhance comprehension and engagement.

Materials:

- Text variations of "The Winter's Tale"
- Projector and screen
- Handouts with key passages and discussion questions
- Costumes and props (optional, for performance activities)

Session 1: Introduction to the Play (60 minutes)

Objective: to introduce the history and topics of the play to the class.

- 1. Start by having a quick conversation about William Shakespeare's importance in literature.
- 2. Give a summary of the play's plot and themes, which include time passing, forgiving others, and envy.
- 3. Discuss the cultural and historical contexts of the play's settings, Sicilia and Bohemia, using photos of the locations.
- 4. Assign reading homework for Act 1, Scene 1.

Session 2: Act 1 and the Theme of Jealousy (60 minutes)

Objective: Examine the jealousy theme in Act 1 in depth.

- 1. Recount Act 1, Scene 1 to get things started. Talk about the plot, the characters, and the function of jealousy.
- 2. Act 1, Scene 2's main portions should be read and examined. Discuss the effects of King Leontes' jealousy.
- 3. Assign reading homework for Act 2, Scene 1.

Session 3: Acts 2 and 3 - Perdita's Journey (60 minutes)

Objective: Explore Perdita's travels and the rural setting.

- 1. Review Act 2, Scene 1, pointing out the differences between Sicilia and Bohemia's pastoral environment.
- 2. Read Act 2, Scene 3, paying particular attention to Perdita's persona and her interactions with Polixenes and Florizel.
- 3. Discuss the themes of disguise and identity.
- 4. Assign Acts 3 and 4 as reading homework.

Session 4: Reconciliation and Forgiveness in Acts 4 and 5 (60 minutes)

Objective: Consider topics like forgiveness and reconciliation in the last acts

- 1. Recap Acts 3 and 4. Discuss the character growth and shifting dynamics.
- 2. Read and evaluate significant Act 5 passages with an emphasis on the "statue" scene and the idea of reconciliation.
- 3. Discuss the play's resolution and its implications.
- 4. Assign Act 5 as reading homework.

Session 5: Performance and Reflection (60 minutes)

Objective: Encourage your students to perform and reflect while reading the book.

- 1. Divide students into groups and assign each group a scene from the play.
- 2. Have groups prepare and perform their scenes in front of the class.
- 3. Encourage discussions about the themes, emotions, and character motives that were presented during each performance.
- 4. Finish by having the class discuss the play's timeless themes of redemption and forgiveness as well as its current relevance.

Assessment:

- Participation in class discussions and activities.
- Written reflections on the themes and character development in the play.
- Performance of assigned scenes (if desired).

With the help of discussion and performances, students will be able to interact with "The Winter's Tale" in this lesson plan's planned manner. It promotes a greater comprehension of Shakespeare's language and the eternal themes of the play.

Prompt: What rhyming scheme is used in Sonnet 18 of Shakespeare?

ChatGPT's response:

Shakespeare's Sonnet 18 uses the conventional English sonnet rhyme structure of three quatrains (four-line stanzas) and a final couplet (a two-line stanza). Sonnet 18's rhyme pattern is commonly written as ABAB CDCD EFEF GG. This indicates that the first and third lines of each quatrain rhyme with one another, as do the second and fourth lines. The last couplet rhymes with itself
and frequently offers a twist or resolve to the poem's central theme. The rhyming scheme for Sonnet 18 is as follows: "Shall I compare thee to a summer's day? (A) Thou art more lovely and more temperate: (B) Rough winds do shake the darling buds of May, (A) And summer's lease hath all too short a date: (B) Sometimes too hot the eye of heaven shines, (C) And often is his gold complexion dimm'd; (D) And every fair from fair sometime declines, (C) By chance or nature's changing course untrimm'd; (D) But thy eternal summer shall not fade (E) Nor lose possession of that fair thou owest; (F) Nor shall Death brag thou wanderest in his shade, (E) When in eternal lines to time thou growest: (F) So long as men can breathe or eyes can see, (G) So long lives this, and this gives life to thee." (G) The sonnet's structure, pace, and overall literary effect are all influenced by the rhyme scheme. Prompt 1

Mona Ragab

ChatGPT response

I am sorry, but my training data do not have any precise information about a person called Mona Ragab. Please provide more context or facts if you have a query or require information regarding a specific Mona Ragab, and I will try to help you.

Prompt 2 ChatGPT response

I will try tomorrow a Certainly! Anytime you want to talk about or continue working on your short story short tale, feel free to come back. I will be here to help if you need clarification, direction, or just someone to bounce ideas from. Good luck with your writing, and I look forward to assisting you with your short story whenever you are ready!

Prompt 3ChatGPT responseI will try tomorrow is
the title of the short
storyAh, I see! "I Will Try Tomorrow" sounds like an intriguing title for a short
story. Titles play a crucial role in drawing readers in and setting the tone
for the narrative. If you have any specific questions or need assistance with
anything related to your short story, such as brainstorming ideas, develop-
ing characters, or crafting the plot, please feel free to share, and I'll be
happy to help. Good luck with your writing, and I hope your story turns
out great!

The limited answers provided by ChatGPT encourage one to think about further prompts. The limitations of ChatGPT can have the effect of engaging in a detailed conversation with it. This conversation awakens critical thoughts, where one would use a series of creative prompts and detailed questions to receive appropriate information. This is what I would call the counter-effect of ChatGPT. ChatGPT can be an effective tool for creating a literature course. One asked ChatGPT to Generate a lesson plan on Shakespeare's The Winter's Tale. ChatGPT's answer includes all elements of a lesson plan, which provides the lesson objectives, the level of students, the materials to be used, the duration of the course, and the topics to be covered in each lesson. Teachers can develop original literature discussion lessons using ChatGPT. It can also be used to design activities as highlighted below:

The Prompt: Design an activity for students on Jane Austen

Activity Title: "Jane Austen Character Collage"

Objective: The goal of this activity is to provide students with a deeper knowledge of the personalities, motives, and character development of the characters developed by Jane Austen in her novels. Critical thinking, creativity, and literary analysis are all encouraged by this practice.

Materials Needed:

- 1. Copies of the works of Jane Austen (e.g., "Pride and Prejudice," "Sense and Sensibility," "Emma," etc.)
- 2. Supplies for making art (colored pencils, markers, magazines, scissors, glue, poster boards, etc.)

3. Access to research resources at a library or on a computer

Instructions:

- 1. Introduction (15 minutes): Give students some background knowledge on Jane Austen, her life, and her contributions to English literature at the start of the activity. You might also briefly go over the themes and traits that recur in her books, like socioeconomic class, marriage, and women's roles.
- 2. Character Choice (15 minutes): Depending on class size, divide the students into small groups or let them work alone. Each group or student should select one character to analyze from a Jane Austen book. to ensure

that the class discussions are diverse, encourage them to choose characters with a range of characteristics and backgrounds.

- 3. Character Assessment (30 minutes): Give students the assignment of researching the character they have chosen. They should read the pertinent chapters, make notes on how the character behaves, develops, and changes throughout the narrative, and consider how the character interacts with other characters.
- 4. Establish a Character Collage (45 minutes): Give the students art supplies and a collage-making lesson to help them visualize the figure they have chosen. to illustrate the character's look, personality features, and crucial passages from the novel, students can utilize periodicals, sketches, or printed photos from the internet. Encourage artistic expression and inventiveness.
- 5. Presentations (20 minutes): Have each group or student present their character collage to the class. During the presentation, they should discuss:
 - The character's name, novel, and author.
 - A summary of the character's role in the story.
 - The character's personality traits, values, and flaws.
 - Any significant character development or changes throughout the novel.
 - How the character contributes to the overall themes of the novel.
- 6. Group Discussion (15 minutes): After each presentation, facilitate a class discussion by asking questions like:
 - How does the character's personality align with the social norms and values of the period?
 - What challenges or conflicts does the character face in the story?
 - How does the character's journey contribute to the novel's themes?
 - Are there any similarities or differences between characters from different novels by Jane Austen?
- 7. Conclusion (10 minutes): Wrap up the activity by summarizing key insights and takeaways from the character analyses. Encourage students to reflect on the universality of human traits and the enduring relevance of Jane Austen's characters in today's society.

The ChatGPT provides a rhyme scheme for poems. We asked ChatGPT to provide us with the rhyme scheme of Shakespeare's *Sonnet 18*. ChatGPT has generated a full sonnet with ending rhymes, further explaining the sonnet's typical form. ChatGPT for teachers of literature is a tool that fosters creativity, with a human prompt and original questions; it can generate creative activities on literary analysis, character analysis, studying rhyme, literary text style, or prosody, enriching critical perspectives of teachers. For students, ChatGPT can

diminish their creativity if they rely solely on its generated content. When we asked ChatGPT to provide the themes mentioned in the novel *Cuba I Was a German Shepherd*, ChatGPT highlighted key themes in the novel. Students can use these themes to develop a coherent piece of writing. Students should be directed by their teachers to the knowledge and use of ChatGPT. It shall not feed students' thinking; on the contrary, it must raise their capability to criticize the information generated by asking, comparing, and further researching the validity of the information. Rudolph, Tan, and Tan recommended using the flipped learning strategy, which requires students to prepare for courses by studying pre-class materials utilizing ChatGPT. This method allows for more practice and discussion in class.

Ethical Integration of AI in Literature Classroom

Through the ethical integration of AI, learning experiences in the literature classroom can be considerably improved, encouraging increased engagement with literary texts. However, it is important to approach this integration with a strong sense of wisdom and accountability. Here, we lay out a detailed strategy for incorporating ethical AI into literature classes.

The guiding principles of this integration are, first, openness and permission. It is crucial to give students clear explanations of how AI tools are used in the classroom, explaining the goals, potential, and constraints of the technology. Students should also be asked for their approval after being fully informed of the potential uses of their data and given assurances of strong privacy safeguards.

In the classroom, AI can be used as a potent tool for analysis and study. AI can dramatically improve processes like text analysis, summarization, and sentiment analysis. With the help of these resources, students can better understand and analyze complex literary texts, developing their critical thinking and understanding of literature.

AI can also be used to support individualized learning. Reading assignments or conversation topics can be customized to the unique interests and academic levels of each student using artificial intelligence (AI). As a result of this customization, which acknowledges and respects the different learning preferences and styles of its pupils, engagement with the subject matter is increased.

It is crucial to stress that AI should be used as a tool, not as a substitute for communication and guidance from humans. AI's role in education is to enhance and support learning, fostering a richer learning environment where technology enhances rather than replaces the crucial function of teachers.

Ethical considerations are paramount in the ethical integration of AI. to protect the privacy of students' data, strong data security measures must be adopted. Moreover, it is imperative to prohibit the disclosure of student data or personal information to third parties without explicit permission, ensuring the utmost protection of students' sensitive information.

Bias mitigation is another critical aspect of this integration. Recognizing and acknowledging potential biases in AI algorithms, particularly those influenced by gender, ethnicity, or cultural preconceptions, is vital. Encouraging students to engage in discussions regarding how AI-generated content relates to the literature they are studying and to critically evaluate it for bias fosters a nuanced understanding of this aspect.

Furthermore, responsible AI development should be a subject of discussion in literature classes. Engaging students in conversations about the ethical considerations and responsibilities of AI developers and users provides them with a broader perspective on the societal implications of AI, not only within literature but also in wider contexts.

Teaching digital literacy is integral to this integration. Incorporating digital literacy skills into the curriculum ensures that students are well-informed about AI, its applications, and its ethical implications. Equipping students who can evaluate and question AI-generated content and interpretations empowers them to be critical thinkers in the age of AI.

Feedback mechanisms should also be established to allow students to offer input on the use of AI in the classroom, both positive and negative. This feedback serves as a valuable resource for refining and improving the integration of AI in future classes, making it an evolving and student-centric process.

Finally, continuous ethical reflection is encouraged. Ongoing conversations and reflection on the ethical implications of AI in literature education foster an ethically conscious culture. Staying updated on evolving ethical guidelines and best practices in AI education ensures that the integration remains aligned with ethical standards

Conclusion

To promote critical thinking in classrooms, literature teachers can adhere to a comprehensive set of guidelines. First, they should acquire a thorough understanding of AI capabilities and limitations before integrating AI tools into their teaching methods. This understanding encompasses knowledge of various AI tools available for literature analysis, such as sentiment analysis, text summarization, as well as natural language processing. Next, educators should be discerning in their choice of AI tools, opting for those sourced from reputable providers with a record of accomplishment of accuracy and ethical standards, and ideally, tools tailored for literary analysis.

Moreover, teachers should emphasize to their students that AI serves as a supplementary aid rather than a replacement for human interpretation, encouraging students to regard AI-generated insights as one perspective among many. Critical evaluation of AI-generated insights is paramount, and students should be trained to scrutinize the quality and relevance of AI-generated analyses or interpretations, engaging in discussions regarding potential biases and limitations inherent in AI algorithms. An interdisciplinary approach is encouraged, fostering discussions that integrate AI tools with other subjects like ethics, computer science, or data literacy to provide a holistic perspective on AI's impact on literature.

Additionally, it is essential to explicitly define learning objectives tied to critical thinking when employing AI tools, clarifying how AI contributes to achieving these objectives alongside traditional literary analysis methods. Classroom discussions should be fostered, where students are expected to communicate their viewpoints on AI-generated insights, promoting healthy debates and allowing students to challenge AI-generated interpretations. Furthermore, hands-on experiences should be offered to students, granting them the opportunity to use AI tools themselves, which can enhance their understanding of algorithms and limitations, leading to more informed discussions.

Ethical considerations should also be incorporated into the curriculum, encompassing debates on the ethical implications of AI usage in literature analysis, including privacy, bias, and the responsibilities of AI developers. Collaborative learning projects are advocated, where students collaborate in teams to analyze literature using AI, thus promoting diverse perspectives and critical thinking. Teachers should reflect on their pedagogical approaches, considering new methods or strategies that align with the incorporation of AI in the literature classroom and adapting their pedagogy as needed.

Furthermore, feedback mechanisms should be put in place to allow students to submit feedback on their experiences using AI tools in the literary classroom, allowing for the improvement of techniques in future courses. Continuous vigilance and staying updated on AI advancements in literature analysis are imperative, including attending conferences, reading relevant literature, and engaging with the AI research community.

Respect for student privacy is essential and should ensure that any data collected during AI-powered activities respects students' privacy. Clear communication should be maintained regarding how their data will be used, with their consent sought when necessary. Finally, teachers should encourage students to think about the ethical use of AI outside of the classroom, emphasizing responsible AI use and decision-making in real-world circumstances. By diligently following these guidelines, literature teachers can effectively harness AI tools to enhance critical thinking skills, all the while fostering ethical awareness and responsible AI use among their students

References

- Bazeley, P. (2006). The contribution of computer software to integrating qualitative and quantitative data analyses. Research in the Schools, 13(1), 64-74.
- Bostrom, N. (1998). How long before superintelligence? Retrieved from https://nickbostrom.com/superintelligence.html
- Bruce, I. (2014). Expressing criticality in the literature review in research article introductions in Applied Linguistics and Psychology. English for Specific Purposes, 36, 85–96. https://doi.org/10.1016/j.esp.2014.06.004
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitraitmultimethod matrix. Psychological Bulletin, 56, 81–105. https://doi.org/10.1037/h0046016.
- Duan, J. (2012, 14-17 July 2012). Research about technology-enhanced higher-order thinking. Paper presented at the Computer Science & Education (ICCSE), 2012 7th International Conference on.
- Ennis, R. H. (1989). Critical thinking and subject specificity: Clarification and needed research. Educational Researcher, 18(3), 4–10
- Facione, P. (2015). Critical thinking: What it is and why it counts. Measured Reasons LLC. https://www.measuredreasons.com/index_htm_files/what&why2015.pdf
- Fullan, M., & Donnelly, K. (2013). Alive in the swamp: Assessing digital innovations. Retrieved from London:
- Heffernan, N. T., & Heffernan, C. L. (2014). The ASSISTments ecosystem: building a platform that brings scientists and teachers together for minimally invasive research on human learning and teaching. International Journal of Artificial Intelligence in Education, 24(4), 470–497. https://doi.org/10.1007/s40593-014-0024-x
- J. M. Spector, M. C. Polson, D. J. Muraida (eds.), Automating Instructional Design: Concepts and Issues (Educational Technology Publications, Englewood Cliffs, 1993)
- K. Siau, Y. Yang, in Twelve Annual Midwest Association for Information Systems Conference (MWAIS 2017). Impact of Artificial Intelligence, robotics, and Machine Learning on Sales and Marketing (2017), pp. 18–19
- Koedinger, K. R., & Corbett, A. T. (2006). Cognitive tutors: technology bringing learning science to the classroom. in K. Sawyer (Ed.), The Cambridge Handbook of the Learning Sciences (pp. 61– 78). New York: Cambridge University Press.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: an argument for AI in education. Resource document. https://static.googleusercontent.com/media/edu.google. com/sv//pdfs/Intelligence-Unleashed-Publication.pdf. Accessed June 2023.
- Maknun, J. (2019). The development of critical thinking skills in vocational high school students in Indonesia. International Journal of Innovation, Creativity, and Change, 7(12), 237-258. https://doi.org/10.1177%2F1475725717723837
- Mojica, K. D. (2010). Ordered effects of technology education units on higher-order critical thinking skills of middle school students. (Doctor of Professional Studies in Computing D.P.S.), Pace University, Ann Arbor. ProQuest Dissertations & Theses Global database.
- Mok, F., & Yuen, T. (2016). A critical evaluation of the understanding of critical thinking by school teachers: The case of Hong Kong. Citizenship, Social and Economic Education, 15(1), 28-44. https://doi.org/10.1177/2047173416652146
- Nold, H. (2017). Using critical thinking teaching methods to increase students' success: An action research project. International Journal of Teaching and Learning in Higher Education, 29(1), 17-32. Retrieved from https://files.eric.ed.gov/fulltext/EJ1136016.pdf
- Onwuegbuzie, A.J. (2003). Expanding the framework of internal and external validity in quantitative research. Research in the Schools, 10(1), 71-90.
- Parde, Natalie, and Rodney D. Nielsen. "AI Meets Austen: Towards Human-Robot Discussions of Literary Metaphor." Artificial Intelligence in Education, 2019, pp. 213–19. Crossref, https://doi.org/10.1007/978-3-030-23207-8_40.
- R. Cellan-Jones, Stephen Hawking warns artificial intelligence could end mankind. BBC. News. 2, 2014 (2014)

- Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. International Journal of Artificial Intelligence in Education, 26(2), 582–599. https://doi.org/10.1007/s40593-016-0110-3
- Rudolph, J., Tan, S., Tan, S.: ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? J. Appl. Learn. Teach. 6(1), 1–22 (2023)
- Saleh, S.E. (2019). Critical thinking as a 21st-century skill: Conceptions, implementation, and challenges in the EFL classrooms. European Journal of Foreign Teaching, 4(1), 1-17. https://doi.org/10.5281/zonodo.2542838
- Sokolov, M. (2001). Technology's impact on society: The issue of mass-customized education. Technological Forecasting and Social Change, 68(2), 195-206. doi:http://dx.doi.org/10.1016/S0040-1625(99)00118-3
- Spector, Jonathan & Ma, Shanshan. (2019). Inquiry and critical thinking skills for the next generation: from artificial intelligence back to human intelligence. Smart Learning Environments. 6. 10.1186/s40561-019-0088-
- Tai, J., Ajjawi, R., Boud, D., Dawson, P., & Panadero, E. (2018). Developing evaluative judgment: Enabling students to make decisions about the quality of work. Higher Education, 76, 467–481. https://doi.org/10.1007/s10734-017-0220-3
- Tashakkori, A., Teddlie, C.: Mixed Methodology, Combining Qualitative and Quantitative Approaches. Sage, London (1998)
- VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. Educational Psychologist, 46(4), 197–221. https://doi.org/10.1080 /00461520.2011.611369.
- Wang, Y., Li, H., Feng, Y., Jiang, Y., Liu, Y.: AI-supported online collaborative learning: an exploratory study on group problem-solving processes and outcomes. Comput. Educ. 145, 103717 (2020)
- Wingate, U. (2012). 'Argument!' helping students understand what essay writing is about. Journal of English for Academic Purposes, 11(2012), 145-154. https://doi.org/10.1016/j.jeap.2011.11.001
- Zenisky, A. L., Lisa A. Keller, and Xi Wang. (2014). De-constructing Constructs: Evaluating Stability of Higher-Order Thinking Across Technology-Rich Scenarios. Paper presented at the Annual Meeting of NCME, Philadelphia, PA, April 4-6, 2014.
- Abdulai, A. and Hung, L. (2023). Will chatbots undermine ethical values in nursing education, research, and practice? Nursing Inquiry, 30(3). https://doi.org/10.1111/nin.12556
- Clark, T. (2023). Investigating the use of an artificial intelligence chatbot with general chemistry exam questions. Journal of Chemical Education, 100(5), 1905-1916. https://doi.org/10.1021/acs.jchemed.3c00027
- Feng, S. and Shen, Y. (2023). Chatgpt and the future of medical education. Academic Medicine, 98(8), 867-868. https://doi.org/10.1097/acm.00000000005242
- Humphry, T. and Fuller, A. (2023). Potential chatbot use in undergraduate chemistry laboratories. Journal of Chemical Education, 100(4), 1434-1436. https://doi.org/10.1021/acs.jchemed.3c00006
- Qadir, J. (2022). Engineering education in the era of chatbot: promise and pitfalls of generative AI for education.. https://doi.org/10.36227/techrxiv.21789434
- Sallam, M., Salim, N., Barakat, M., & Al-Tammemi, A. (2023). Chatgpt applications in medical, dental, pharmacy, and public health education: a descriptive study highlighting the advantages and limitations. Narra J, 3(1), e103. https://doi.org/10.52225/narra.v3i1.103
- Sun, G. and Hoelscher, S. (2023). The chatbot storm and what faculty can do. Nurse Educator, 48(3), 119-124. https://doi.org/10.1097/nne.000000000001390
- Tlili, A., Shehata, B., Adarkwah, M., Bozkurt, A., Hickey, D., Huang, R., ... & Agyemang, B. (2023). What if the devil is my guardian angel: chatbot as a case study of using chatbots in education. Smart Learning Environments, 10(1). https://doi.org/10.1186/s40561-023-00237-x
- Almahasees, Z. (2017). Machine translation quality of Khalil Gibran's The Prophet. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3068518
- Hou, X., Omar, N., & Wang, J. (2022). Interactive design psychology and artificial intelligence-based innovative exploration of Anglo-American traumatic narrative literature. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.755039

- Jing-xia, L. (2022). Emotion expression in modern literary appreciation: an emotion-based analysis. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.923482
- Mak, M. and Willems, R. (2018). Mental stimulation during literary reading: individual differences revealed with eye-tracking. Language Cognition and Neuroscience, 34(4), 511-535. https://doi.org/10.1080/23273798.2018.1552007
- Omar, A. (2020). Feature selection in text clustering applications of literary texts: a hybrid of term weighting methods. International Journal of Advanced Computer Science and Applications, 11(2). https://doi.org/10.14569/ijacsa.2020.0110214
- Omar, A. (2021). Identifying themes in fiction: a centroid-based lexical clustering approach. Journal of Language and Linguistic Studies, 580-594. https://doi.org/10.17263/jlls.903518
- Omar, A. (2021). Towards a computational model to a thematic typology of literary texts: a concept mining approach. International Journal of Advanced Computer Science and Applications, 12(12). https://doi.org/10.14569/ijacsa.2021.0121226
- Pillai, R. and Sivathanu, B. (2020). Adoption of artificial intelligence (AI) for talent acquisition in /its organizations. Benchmarking an International Journal, 27(9), 2599-2629. https://doi.org/10.1108/bij-04-2020-0186
- Ribeiro, M., Singh, S., & Guestrin, C. (2016). "why should I trust you?".. https://doi.org/10.1145/2939672.2939778
- Wei, C. (2022). Copyright protection and data reliability of AI-written literary creations in a smart city. Security and Communication Networks, 2022, 1-13. https://doi.org/10.1155/2022/6498468

RECOVERY EDUCATION THROUGH THE PANDEMIC: THE USE OF ARTIFICIAL INTELLIGENCE TO CREATE AN ADAPTIVE LEARNING ENVIRONMENT.

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Recovery education is a process whereby knowledge is created, explored and assimilated in order to support individuals in their personal recovery journeys from mental health challenges. The process whereby this knowledge is created, delivered and evaluated is known as co-production. Co-production creates a mutuality by recognizing the importance of both learned and experiential knowledge [knowledge acquired through living through an experience] in mental health. However, co-production is a slow process and requires agreement on the knowledge created. As such, much recovery education is created and delivered in person within a recovery college setting. in March 2020, the world was essentially shut down by the COVID-19 pandemic. in many educational settings, institutions were closed for months on end. However, due to the creative work of recovery college staff, artificial intelligence through the use of computer technology, like Zoom, were quickly utilized to recommence activity. However, the use of such intelligence has caused a number of challenges as it has benefits. This chapter will examine how a new learning environment was created by artificial intelligence due to the COVID-19 pandemic and its effect on society. It discusses these benefits and challenges as well as exploring what has been learnt from the transfer of recovery education from physical to virtual learning environments.

Introduction

Since the mid-1800's when psychiatry was first formed as a medical discipline, services have operated, and to some extent continue to operate under a biomedical approach. Such an approach/model identifies those with mental health difficulties as passive patients, cursed by an imbalance of neurotransmitters, possibly resulting from a poor genetic makeup which was attributed to them during conception and/or gestation. Additionally, such disorder may have also resulted from physical malformations in the brain structure itself, likely resulting from physical trauma experienced either intentionally or acci-

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dentally throughout the life cycle. Regardless, history has taught us that despite the cause, such individuals were treated poorly as a result. Such poor treatments included trephination, bloodletting/purging and lobotomy to name just a few (Kelly, 2022). However, as the 1900s progressed so too did medical advancements in the field of psychiatry away from such barbaric treatments towards the use of psychotropic medications (Norton, 2022). Soon after a civil rights movement would pave its way through Northern America and bring with it the birth of a new movement which over the past few years has created extensive structural, organisational, and philosophical change in the way mental health services are conceptualised, structured and delivered (Norton, 2021). This movement is simply known as the mental health recovery movement and has strong links with human rights-based work which was evident from around the time of its conceptualisation.

When one speaks of mental health recovery in this context, they are actually referring to that of personal recovery. Personal recovery is both a philosophical concept and a wider movement within the space of mental health service provision. It is difficult to define due to its multi-faceted origins and diversity in the said experience. However. William Anthony suggests in his seminal 1993 work that personal recovery refers to more than just the mere reduction/elimination of symptoms of mental distress, rather it examines ways in which one can live a more meaningful and contributing life even with the constraints imposed on the person by their ongoing difficulties (Anthony 1993). This definition suggests that recovery is a journey of self-exploration which goes beyond psychopathology towards quality of life and self-fulfillment (Norton and Cuskelly, 2021). However, despite having a deeply personal meaning for individuals suffering from mental health challenges, it is also of organizational importance (Health Service Executive, 2017). Yet within services, the concept remains an ongoing challenge to implement and sustain (Mabe et al., 2016). One such reason may be because of its linkages to radical perspectives within mental health discourse where mental health challenges are not viewed as simply a disease, rather, they are the result of trauma and stress that can arise in an individual at any point during the lifespan (Goh and Agius, 2010; Read 2013).

Since the establishment of the personal recovery movement within mental health discourse, Services have rejected the notion of solely operating through a biomedical model to now claiming to practice in a way that is more conducive of the biopsychosocial approach (Xiao et al. 2021). Such attempts to shift towards this lens of service provision can be seen commencing around the time of the creation of Anthony's seminal definition of personal recovery and continues, in some shape or form to this very day. For example, services have closed down the original asylums of the time and replaced them with timely

community orientated services (Department of Health [DoH], 2006). Additionally, services are beginning to recognise the recovery journey of family members of loved ones with mental health challenges and as a result have started to be more inclusive of family recovery with each passing day as new evidence into the concept continues to emerge (Norton and Cuskelly, 2021; Cuskelly et al. 2022). Finally, the recognition of lived experience as a knowledge subset in its own right is now an imperative realisation that impacts all facets of service provision (Norton 2023). This realisation is important as it paves the way for the use of such expertise along with learned knowledge so that a more complete interpretation of a phenomena can be created. One way in which this collaborative effect can be achieved is through the co-production of recovery education initiatives as part of overall mental health service provision. Indeed, the focus of this chapter is on the inner workings of co-production for recovery education purposes before, during and after the COVID-19 pandemic. This will be done in order to identify what impact, if any, the introduction of artificial intelligence has on the creation of a coproductive, adaptable learning environment for those who utilised recovery education services during these time periods. However, before this analysis can commence, an exploration of recovery education and it's importance in the personal recovery movement will now occur below.

Recovery Education, An Introduction

As suggested in the introduction to this chapter, in recent years, lived experience, termed here as experiential knowledge, has become recognised and valued within the mental health setting (Conner et al. 2015). Such recognition occurs in two main facets: the first involves the therapeutic use of lived experience to support those with similar mental health challenges in recovery. Common examples of this in action include peer support work where it is used in the creation of informality, essential to achieve in order for peer support work to have any effect on the individual concerned (Norton, 2022a). The second facet involves the fusion of this knowledge with learned knowledge to support recovery educational initiatives. This chapter will focus on the latter utilisation of experiential knowledge: to fuse with learned knowledge to support recovery education. However, before this can occur, we must firstly examine the glue that allows for such fusion to take place. This glue is simply known as co-production.

Norton, (2022) defines co-production as: "the creation and continuous development of a dialogical space where all stakeholders, including service users, family members, carers, supporters and service providers enter a collaborative partnership with the aim of not only improving their own care but also that of service provision" (pg. 27). However, although this definition is routed in mental health and recovery, it is deemed void in other context due to the variety of mechanism whereby co-production is employed across various sectors of society. For example, economics and politics. As such, although acknowledging that co-production has multiple facets attached, this chapter will focus on its application within mental health services. As a concept, co-production is observed as the central mechanism used to centralise and infuse lived experiences within mental health discourse (Norton, 2022b). It recognises the value that all stakeholders bring to the table from their own knowledge sets and life experiences and as such acts as the catalyst that allows such fusion of knowledge sets to occur. This is most noticeable in recovery education services where such fusion is meant to create a more complete understanding of a phenomena under examination. But the question remains, what is recovery education and why is it an important aspect of recovery orientation within today's mental health services?

In recent years, recovery education has become a popular medium by which services provide health education and promotion to those who utilises such services, their family members/carers/supporters and to the wider community (Backett-Milburn and Wilson, 2000). Put simply, the concept can be defined as a process of exploring, assimilating, and creating knowledge that is required to support the recovery journeys of service users and their extended family members/carers and supporters (Health Service Executive 2020). This enquiry and assimilation is achieved through the adult education ethos of active, challenging learning which supports reliance, self-agency, and self-directedness (Health Service Executive 2020a). Recovery education is unique as, according to Meddings et al., (2015), the process offers a unique perspective on fundamental processes that underpin mental health. Often these perspectives go beyond the constricting parameters of the biomedical model. in doing so, services that offer recovery education encourage and support students to pursue their own personal life goals through the holistic understanding of their own difficulties and also through supporting students in developing skills to support selfmanagement (Meddings et al., 2015).

In most services where recovery orientation is embedded, the conduct of recovery education for the most part, centres around a hub, known here as a recovery college. Recovery colleges are a relatively new initiative in statutory mental health services (Hayes *et al.* 2022). They are created based on the values of co-production, adult learning methodology [andragogy], peer support and self-management (Ebrahim *et al.* 2018). The first recovery college emerged from the United States in the 1990s (Whitley *et al.* 2019; Hayes *et al.* 2022). Since then, it has spread to several other westernized countries including the United Kingdom in the early 2000's and more recently, Ireland (Perkins et al., 2018). in Ireland, the first recovery college was Mayo Recovery College, situated on the grounds of Atlantic Technological University in Castlebar, which began operations in 2014 (Health Service Executive n.d.; Hunter *et al.* 2022). in Ireland alone, there are now eight recovery colleges and two recovery education services that work with local mental health services to provide recovery education to both staff, service users and family members/carers/supporters of these said services (Health Service Executive, 2023). Such recovery colleges are manned by three separate types of employees. Firstly, there are Peer Educators. These are individuals with lived experiences of mental health/addiction difficulties and are employed to support Recovery Education Facilitators and volunteers in the co-production of recovery education programmes. Recovery Education Facilitators deliver a suite of recovery education programmes on offer in recovery colleges, enhanced by their own lived experiences. Examples include Wellness Recovery Action Planning [WRAP] and Minding my Mood. The person with overall managerial and governance responsibility for recovery education initiatives in a particular area is the Recovery Co-Ordinator who is usually supported in their duties by administration staff.

All programmes within recovery colleges are developed using a co-production process which ensures the fidelity and credibility of the material delivered. See Figure 1 below for an example of a co-production process developed by one such recovery college: the Recovery College South East, which is situated, as the name suggests, in the south east of Ireland. The co-production process allows for the fusion of both learned and experiential knowledge so that both perspectives on a topic are observed by students. From a professional view-point, this systematic and rigorous process also allows for the workshop material to fully comply with evidence-based practice standards that are integral to health education as described by Melnyk et al., (2009). However, from the student's perspective, new doors are opened to them through this fusion, as real-life experiences of battling through mental health difficulties are uncovered and displayed through the candid exposure of experiential knowledge by the lived experience facilitator.

In normal times, recovery education is co-designed and co-delivered face-toface in a variety of public environments. However, crucial to its success is the movement away from a pedagogy approach, used in school education, towards andragogy. Andragogy is an approach to adult education that relies on the experiences and knowledge of the students and not the facilitator thus requiring both parties to be equal in the co-productive space (Kapur, 2015). in this way, Peer Educators act as facilitators in the learning process, not the deliverers of same. Andragogy has a number of practical and intellectual benefits for both facilitator and student (Chan 2010), including: improved communication and learning which is tailored towards the students' needs. This method of learning requires meaningful interaction and discussions with students which is best observed via face-to-face learning within a recovery college. However, in March 2020, recovery colleges had to drastically upgrade the mechanism of recovery education co-design, co-delivery, and co-evaluation due to the onset of a global pandemic which would have long lasting health implications for now and long into the future. This pandemic was caused by the onslaught of the COVID-19 virus.



Figure 1: Recovery College South East Co-Production Process - (Health Service Executive, 2018)

The Rise of COVID-19

In December 2019, a cluster of patients admitted to Wuhan Jinyintan Hospital in Hubei province, China was tested for different viral diseases after developing a pneumonia of an unknown cause (World Health Organization 2020). Testing was carried out in-line with Chinese protocols developed after the outbreak of the Severe Acute Respiratory Syndrome [SARS] viral infection in 2003 (Hung 2003). From this, a new strain in a family of serious virial infections, known as coronavirus, was discovered. in the months that followed, this strain, technically called SARS-CoV-2 would become infamously known as COVID-19.

COVID-19 is the cause of a serious respiratory infection which has spread across the globe. It is characterised in its early stages by flu-like symptoms including fever, cough, nausea, vomiting and diarrhoea (Guan et al. 2020). However, for those with underlying health issues, such as those with respiratory diseases, like chronic obstructive pulmonary disease [COPD], this strain can cause more serious, life-threatening symptom including: an elevated respiratory rates [>30 breaths per minute], decreased oxygen saturations, respiratory failure that could require mechanical ventilation, septic shock or other organ dysfunctions that could lead to death if intensive hospital-based treatment interventions are not delivered (Verity et al., 2020). According to the World Health Organisation (2023) in the three years since COVID-19 was discovered, the total number of COVID-19 cases recorded globally at time of writing was 768,560,727 with 6,952,522 cases resulting in the death of the individual infected.

Since its initial detection, COVID-19 infections have soared on at least three separate occasions. The initial growth occurred at such an alarming rate that within a matter of weeks, the World Health Organization upgraded the virus status from that of an epidemic to a pandemic (Cucinotta and Vanelli, 2020). According to the National Geographic, (2023), an epidemic is a term used to describe the occurrence of an illness within a community/region that demonstrates an excess from normal expectations for that population within a specific time frame. A pandemic is an escalation of an epidemic whereby such infections are so widespread that they effect multiple communities and/or regions (Doshi, 2011). This was the case for COVID-19. Previous to COVID-19, the last known pandemic recorded was in 2009 with the outbreak of the Influenza A [H1N1] virus (Centers for Disease Control and Prevention 2019).

Due to this upgraded status and the increased rates of infection from community transmissions, government agencies around the world implemented a range of strategies to decrease the rate of infection and subsequently, decrease the mortality rate. These measures included social distancing, restricted movements, self-isolation [cocooning] and quarantine. All these extra-ordinary measures were put in place with the aim of prolonging/eliminating the spread of infection to such a state that each country's healthcare systems' treatment capacity does not reach a point where the system could not cope with the increased demand [Figure 2] (European Centre for Disease Prevention and Control 2020).



Figure 2: The Effects of Social Distancing Curve – (European Centre for Disease Prevention and Control 2020)

When such measures were in place, this, alongside the misinformation provided by media sources at the time, caused a negative ripple effect on individual citizen's mental health (O'Connor et al., 2020; Wen et al., 2020; Wittmann et al., 2023). According to a review conducted by Brooks et al., (2020) such stringent measures had a negative psychological effect on an individual's health resulting in chronic psychological conditions such as post-traumatic stress disorder [PTSD], anxiety related disorders and other mental health related concerns which can take longer than any viral infection to recover from. Added to this, the prolonged periods of time with no social contact resulting from the closure of educational institutions and other social services, such as schools, offices, institutions, and recovery colleges also had a profound impact on the mental health of those concerned from this sector (Bayham and Fenichel 2020; Catling et al. 2022).

With such measures enforced for prolonged periods of time over the past three years, Peer Educators have had the difficult task of developing new and innovative ways of co-producing recovery education for audiences in order to receive the message of recovery. It is with this task in mind that provided the inspiration for this chapter. Subsequently, in order to understand the results of this task, this chapter aimed to identify the different methods utilised by Peer Educators since the start of the pandemic to provide recovery education services. Additionally, this chapter also aims to examine the mechanism of providing recovery education in today's post-COVID-19 world in order to identify if learnings gained during the three years of the pandemic could be utilised for good in this post COVID climate. However, in order to achieve this, we must first examine what mechanisms were utilised during the pandemic and how they operated to allow recovery education to continue, despite the changing hostile surroundings brought forth by the pandemic itself.

The Use of Artificial Intelligence to Create an Adaptive Learning Environment

As noted above, the onset of the COVID-19 pandemic caused serious disruption in the day-to-day lives of everyone on the planet. in an extremely short length of time, all non-essential facilities were closed down and most of the population – with the exception of health care staff – were forced to remain in their homes and drastically reduce their social contacts in order to prevent infection. Despite this, organizations such as educational institutions and recovery colleges/services still needed to provide educational support for those still requiring support both educationally and personally. For recovery colleges, this support was maintained throughout the pandemic through the use of online technological resources such as Zoom, MS Teams and WebEx. Each of which had benefits to the user but also came with a number of potentially major flaws. For instance, Zoom tends to be useful for classroom-based activities but is not secure enough for confidential discussions that often occur in health care settings. Microsoft Teams on the other hand, is secure but doesn't have the capacity for andragogical discussions and group-based activities required in recovery education. With this in mind, WebEx has been identified as a viable option as it has the ability for both individualised discussions and group-based work and is secure enough for confidential discussions to take place with peace of mind, but its flaw is laid out in its design. WebEx is simply not user friendly in any respect and as a result discourages many from using it.

Added to the confusion at the beginning of the pandemic, there was no specific guidelines for recovery college staff to abide by in deciding what platform to use and what necessary elements of group safety needed to be considered. As a result, this decision came down to personal choice with many who have chosen the option that is most user-friendly to them whilst also allowing them the full array of resources necessary to carry out all recovery education activities. in Ireland, this platform was Zoom. Zoom is useful in many respects. It can be used not just for face-to-face meetings, but also for recovery workshops, coproduction sessions and webinars. to do this, the platform has several key functions. Firstly, Zoom has an option for the facilitator to break up the group into multiple working groups through it's 'break-out rooms' function. These rooms allow for a randomised, yet controlled separation of individuals into separate workspaces where individuals can work together to explore a given topic further. The facilitator, known in Zoom land as the 'host' has the ability to extract participants from these 'break-out rooms' once time is up so that they can provide feedback, just like in a face-to-face session. Whether you are in the 'break-out rooms' or the main theatre, the facilitators and participants [if the 'host' enables this function] has the ability to share their screen. This setting enables the audience to view PowerPoint presentations, word documents, photos and videos. It also allows the 'host' the ability to bring up a whiteboard where ideas can be taken down/drawn. The beauty regarding this function is that the 'host' can save the whiteboard at any time and view/distribute it after

the session ends. Additionally, Zoom also allows for recordings to occur. Although not appropriate in the recovery education space, it is useful in other teaching environments as it allows teachers/lecturers to record class material and upload it onto a virtual learning environment for student to access at their leisure. Finally, Zoom also has an option of recording transcripts from conversations had on the platform itself. Although also not suitable for recovery education, it is useful for those undertaking qualitative interviews for dissertation purposes, as once the interview is completed a transcript is immediately available for downloading and uploading to data analysis software such as NVivo. However, this is another area where issues regarding intrusion into confidential discussions has occurred and thus raises ethical concerns in the conduction of research on this platform.

As highlighted previously, the use of Zoom for research purposes is concerning. This concern is also placed within the recovery education space also. Recovery education is the only medium by which learned and experiential knowledge can be fused to create new knowledge. Experiential knowledge comes from the lived experiences of mental health distress and subsequent recovery (Norton et al., 2023). As noted earlier, mental health is still stigmatised within today's society. The use of artificial intelligence in the coproduction of recovery education is concerning as there are a multitude of methods, as already described, that can be used that can impact privacy. Take for instance, the platform Zoom. Zoom has the ability to both record and transcribe a co-production meeting. It also has the ability to save chats and any whiteboards used during these meetings. This becomes problematic when exploring experiential experiences and ideas as the services user and/or their family member/carer/supporter may disclose information that may lead to vulnerability within the space. This vulnerability could then be exploited for financial and/or other types of gain if the wrong person holds this information.

As with any initiative, there are many potential benefits and challenges in the use of artificial intelligence, such as Zoom, for recovery educational purposes. Some of these benefits and challenges have already been noted in the available academic literature even though not totally related to recovery education (Naslund et al., 2014; O'Leary et al., 2017). This text will firstly explore the benefits, followed by the challenges in such use of such artificial intelligence in the co-production of recovery education. The benefits to be discussed here include the idea of escapism, opening up a new world, reaching a larger audience and finally the availability of supports beyond business hours.

For many, access to recovery education has been a source of escapism during the pandemic. For instance, an escape from the boredom associated with in house lockdown and a five-kilometre restriction on travel. However, recovery education was also a source of escapisms from the constant bombardment of negative media coverage associated with COVID-19. Such escapism was vital as such coverage of the pandemic at this time was associated with increased warning signs of mental distress such as worry and hopelessness (Kellerman et al., 2022; Price et al., 2022). An escape to recovery education allowed individuals the opportunity to reengage in past self-care techniques vital for the maintenance of positive mental health. This was achieved through a mixture of course material and informal peer support. Thus, opening up a new world for people. This new world allowed people to access new information and resources to support their own recovery. It also opened up a new world in terms of accessing informal support that are not constricted by usual business hours, as individuals can link into recovery education resources across the globe at any time. People using the service also managed to avail of informal peer support which allowed this community to ask for and share ideas/tips that they found useful in their own recovery, particularly during COVID-19. All of which supported the reduction in isolation for these individuals (Gonzalez-Padilla and Tortolero-Blanco 2020). Added to this, many recovery colleges at this time noted an increase in the number of people utilising recovery educational services compared to pre-pandemic levels (Hunter et al. 2022). A stark example of this openness to a new world is captured by the words of those using the services where anecdotally, they have reported that they would never have gone to the recovery college pre-COVID-19 due to issues of stigma and the constraints imposed on such individuals by their mental health difficulties.

Similarly, there have also been several key challenges to the use of artificial intelligence in recovery education including issues of organisational structures/policies, digital poverty and fidelity towards both co-production and other internationally based set programmes including WRAP. Although, there is ample choice of digital software to use, they present a challenge to their use. According to Chang et al, (2020) there is a lack of appropriate guidance into their safe and effective use within the field of recovery education. Anecdotally, in Ireland, different geographical areas are permitting different software to others within the one health service. This has resulted in immense confusion which inadvertently delays and subsequently inhibits the delivery of any digital health service, including recovery education. Although, this has significantly improved in the years since the onset of COVID-19, the lack of guidance on a national level is still evident, with individual services using their own initiative in choice of platform to utilise.

Within health care, ethical consideration should always be given to issues of confidentiality and anonymity (Van Dokkum, 2005). The same applies when using any form of artificial intelligence for recovery education purposes. Although recovery education is a form of educational space, its use of andragogical approaches and techniques for learning, can cause clinically defining infor-

mation to be exposed within the co-produced space. Within a face-to-face session, such potential concerns relating to exposure can be dealt with during a break in the session. However, in an online space, this is more challenging due to the lack of physical connection between facilitators and students. Despite this lack of physical connection with students, using artificial intelligence in the education of students is intrinsically beneficial for them also for several reasons. Firstly, with the rising cost of living, finding appropriate accommodation is difficult for students heading to college (Mannion, 2023). This is noted to have an impact on a student's retention of information they receive during college education (Hamill, 2023). Using artificial intelligence has supported colleges mitigate this issue as through the use of virtual learning environments and platforms like Zoom, education can now be brought home and carried out in the person's own time. This accommodation shortage and its impact on education is less so for recovery education, specifically because recovery education occurs in the local community and secondly, the use of a hybrid model since COVID-19 has made recovery education more accessible to everyone who wants it. Secondly, with the ability to record the lecture and gain access to classroom transcripts, education has become far more accessible to those who for whatever reason cannot have the luxury of studying full time or those who need more time and support to process the information received during such sessions.

However, despite this, the facilitators can take steps to minimise the risk associated with lack of in person contact through the use of group agreements/support documents and car parks/gardens. in addition to this, over the course of a workshop, students may disclose information relating to the welfare of a child or children. As employees who are subconded to the health service, Peer Educators and Recovery Education Facilitators must conform to the policies and procedures of the organisation they are based. Therefore, like any employee of the health service that witnesses or hears a potential concern relating to the welfare of a child or children, they must follow the same procedures as everyone else. This involves informing the individual of the need to break the confidential space, breaking it and reporting to the relevant authorities. of course, this can be more difficult online, due to the ability of the student concerned to disconnect from the call. However, such issues can be minimised as much as possible through the use of an enrolment forms prior to the recovery education session detailing the personal information of the individual attending the workshop.

Another major issue that was quickly identified at the beginning of the pandemic was that of digital poverty. Digital poverty is simply defined as the inability to interact fully, when required with the digital world (Allmann, 2022). According to Seah (2020) a significant proportion of the global population are digitally excluded because they have 1) a lack of access to internet/equipment and/or 2) are considered to be digitally illiterate. to put this into context, in the two years leading to the pandemic, 16% of Irish citizens still did not know how to use the internet, with 18% stating that they have had no access to the internet at this time period (Norris et al., 2021) However, digital poverty cannot entirely be blamed on external conditions (Ruiu et al., 2023), as individuals need to take up opportunities available to them to learn the skills required to interact with the digital world when required. One way in which recovery colleges/ education services could reduce the impact of digital poverty on students could be by organising an introductory session detailing basic IT skills, as part of their preparations for the new term (Health Service Executive 2020b).

Along with digital poverty, other inequities can be exacerbated using artificial intelligence. Within general education constructs, the use of artificial intelligence systems for third level admissions means that ethnic minority and under representative groups of individuals will find it even more difficult to pass admission criteria set by the college as these systems are based on treating all applicants the same without consideration for the unique differences these minorities may have from others within wider society (Hardman, 2023). It is important to note here that artificial intelligence is not more biased than other processes in doing this, but they do amplify these said biases, particularly when it comes to underrepresented, stereotyped and polarised communities (Jennings, 2023). This can potentially translate into the recovery education space as the use of artificial intelligence may firstly suit those with specific learning styles better than others. Secondly, artificial intelligence may exclude certain cohorts, particularly the older generation and to a lesser extent youths due to the inability to utilise such systems or their inaccessibility to them. An example of this is within the forensic setting where the use of artificial intelligence is limited (Puolakka and Van De Steene, 2021). This inadvertently means that there was no access to recovery education during the pandemic for those within the prison or forensic hospital system. This suggestion demonstrates just one example of how the lack of recovery education was exacerbated due to the necessary reliance on artificial intelligence during COVID-19.

Another concerning challenge with the move to artificial intelligence for recovery education is the failure of all stakeholders to uphold the fidelity of coproduction and with the rules governing the delivery of certain programmes within the recovery college/education service setting. As noted earlier, coproduction is the catalyst that allows for the fusion of learned and experiential knowledge necessary for recovery education at its truest form to occur. From Norton's perspective, the shift from face-to-face to online has created challenges in terms of the mechanism of action for the use of co-production online

(Norton, 2022). Most worryingly, however, is the idea that COVID-19 has created a service who provides less of a focus on co-production as a transformative practice. This lack of focus was to the extent that it was not prioritised within the mental health space during the years COVID-19 remained a threat (Yoeli et al. 2022). Keeping to the fidelity of co-production is not the only issue noticed during the COVID-19 pandemic. in addition, there has been a noticeable decrease in adhering to the fidelity of other recovery programmes on offer, including Wellness Recovery Action Planning [WRAP]. in WRAP, facilitators have a number of protocols to follow in order for the programme to be run with fidelity. These include adherence to the values and ethics of the programme, as well as the Copeland Center co-facilitation structure. in addition, the highly participative nature of the programme means that the programme should not be run online unless it is facilitated by an experienced international mentor for the Copeland Center. However, despite this, there is evidence to suggest that programmes were being run online and were not adhering to either the values and ethics and co-facilitation structure. Many articles have been published on WRAP, however, a lot of these are early studies and do not meet current standards in practice. Both of which has led Norton and Flynn (2021) to create a protocol for a systematic review and metaanalysis in order to support the reestablishment of fidelity to the programme. Thankfully, since the recommencement of face-to-face activity, co-productive practice is beginning to shine through again. However, further research is required in order to nail down specific guidance for co-producing within the digital space without the practice itself losing its true meaning.

Conclusion

At time of writing, the world is in its third year of living with COVID-19. Thankfully, we are in a much better place than we were in March 2020 when the pandemic began. On July 01st 2023, the last of the restrictive practices – the COVID certificate for international travel - ceased operations (Citizens Information 2023). Although the restrictions that once made life unbearable have gone, some of the things humanity and indeed recovery education professionals have learned along the way have come to some value, even today. COVID-19 forced all of us to fully embrace the digital world. The use of artificial intelligence in the form of Zoom, MS Teams and WebEx come to us now as second nature. The way co-production occurs is still primarily face-to-face as much as possible, but the delivery of recovery education is now operated through a hybrid approach involving in person students and those connecting through digital communication software. This has allowed for students to benefit from not just local, but national and occasionally, international perspectives. COVID-19 has certainly changed the landscape of recovery education internationally. It has allowed and ragogical approaches to become as inclusive as possible. It has allowed those who would not otherwise receive recovery education to achieve same within the comfort of their own home. Finally, COVID-19 prompted recovery education services to provide a service that supports people through the principles of CHIME – connectedness, hope, identity, meaning and purpose and empowerment – to enhance and maintain their wellbeing in a time period when the world was indeed a dark place to live in. For this, the staff of the recovery colleges/education services should be commended. As a sector, the recovery education services has proven resilient in the face of adversity. However, we have also learned that we need to do more now in order to ensure that the authenticity of recovery education is maintained within the digitally landscape so that if and when another pandemic like COVID-19 occurs again, the sector is prepared for the smooth transition from face-to-face to virtual conduction of their business.

References

Allman, K. (2022) UK Digital Poverty Evidence Review 2022. (Internet) Available at:

https://digitalpovertyalliance.org/wp-content/uploads/2022/06/UK-Digital-Poverty-Evidence-Review-2022-v1.0- com-

pressed.pdf?vgo_ee=rhv4ECD6fJISuBX2ZO4MpMM04tEZGVoA1O4XFqfsZB5DEBj4lPk0cJQ %3D%3ApUClJWP5mFNzDzqcxpZu0n6Ec4lvuFGi, (Accessed 29th July 2023).

- Anthony, W.A. (1993) Recovery from mental illness: The guiding vision of the mental health service system in the 1990s. Psychosocial Rehabilitation Journal 16, 11–23.
- Backett-Milburn, K. & Wilson, S. (2000) Understanding peer education: Insights from a process evaluation. Health Education Research 15(1), 85-96.
- Bayham, J. & Fenichel, E. P. (2020) Impact of school closures for Covid-19 on the US health-care workforce and net mortality: A modelling study. The Lancet Public Health Advanced online publication.
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N. & Rubin, G. J. (2020) The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. The Lancet 395, 912-920.
- Catling, J.C., Bayley, A., Begum, Z., Wardzinski, C. & Wood, A. (2022) Effects of the COVID-19 lockdown on mental health in a UK student sample. BMC Psychology 10, 118.
- Centers for Disease Control and Prevention (2019) 2009 H1N1 Pandemic (H1N1pdm09 Virus). (Internet) Available at: https://www.cdc.gov/flu/pandemic-resources/2009-h1n1-pandemic.html, (Accessed 29th July 2023).
- Chang, B. P., Kessler, R. C., Pincus, H. A. & Nock, M. K. (2020) Digital approaches for mental health in the age of Covid-19. British Medical Journal 369, m2541.
- Citizens Information (2023) Public Health Measures for COVID-19. (Internet) Available at: https://www.citizensinformation.ie/en/health/covid19/public-health-measures-for-covid19/, (Accessed 29th July 2023).
- Conner, K. O., McKinnon, S. A., Ward, C. J., Reynalds, C. F. & Brown, C. (2015) Peer education as a strategy for reducing internalized stigma among depressed older adults. Psychiatric Rehabilitation Journal 38(2), 186-193.
- Cucinotta, D. & Vanelli, M. (2020_ WHO declares COVID-19 a pandemic. Acta Biomedica 91(1), 157-160.
- Cuskelly, K., Norton, M.J. & Delaney G. (2022) Examining the existing knowledge base for enablers for family recovery in mental health: A protocol for a scoping review of national and international literature. BMJ Open 12, e066484.
- Department of Health (2006) A Vision for Change: Report of the Expert Group on Mental Health Policy. (Internet) Available at: https://www.hse.ie/eng/services/publications/mentalhealth/mentalhealth--- a-vision-for-change.pdf, (Accessed 08th May 2023).
- Doshi, P. (2011) The elusive definition of pandemic influenza. Bulletin of the World Health Organization 89, 532-538.
- Ebrahim, S., Glascott, A., Mayer, H. & Gair, E. (2018) Recovery colleges: How effective are they? The Journal of Mental Health Training, Education and Practice 13(4).
- European Centre for Disease Prevention and Control (2020) Consideration relating to Social Distancing Measures in Response to COVID-19 – Second Update. (Internet) Available at: https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-social-distancingmeasuresg-guide-second-update.pdf, (Accessed 29th July 2023).
- Goh, C. & Agius, M. (2010) The stress-vulnerability model how does stress impact on mental illness at the level of the brain and what are the consequences. Psychiatria Danubina 22(2), 198-202.
- Gonzalez-Padilla, D. A. & Tortolero-Blanco, L (2020) Social media influence in the Covid-19 pandemic. International braz j urol 46(1) 120-124.
- Guan, W., Ni, Z., Hu, Y., Liang, W., Ou, C., He, L., Liu, L., Shan, H., Lei, C., Hui, D. S. C., Du, B., Li, L., Zeng, G., Yuen, K-Y., Chen, R., Tang, C., Wang, T., Chen, P., Xiang, C. J., Li, S., Wang, J-L., Liang, Z., Peng, Y., Wei, L., Liu, Y., Hu, Y-h., Peng, P., Wang, J-m., Lui, J., Chen, Z., Li, G., Zheng, Z., Qiu, S., Luo, J., Ye, C., Zhu, S. & Zhong, N. (2020) Clinical characteristics of coronavirus disease 2019 in China. The New England Journal of Medicine Advanced online publication.

- Hamill, S. (2023) Student Accommodation: Without Decent Housing It's Hard to get a Decent Education. (Internet) Available at: https://www.tcd.ie/news_events/articles/2023/trinity-opinionwithout-decent-housing-its-hard-to-get-a-decent-education/, (Accessed 22nd October 2023).
- Hardman, P. (2023) the AI-Education Divide: How the Rise of AI has Reinforced Inequity in Education (and What We Need to do to Reverse It). (Internet) Available at: https://drphilippahardman.substack.com/p/the-ai-education- divivi-

de#:~:text=For%20instance%2C%20if%20an%20AI,inequities%20and%20hinder%20social %20mobility., (Accessed 22nd October 2023).

- Hayes, D., Henderson, C., Bakolis, I., Lawrence, V., Elliott, R.A., Ronaldson, A., Richards, G., Repper, J., Bates, P., Brewin, J., Meddings, S., Winship, G., Bishop, S., Emsley, R., Elton, D., McNaughton, R., Whiltley, R., Smelson, D., Stepanian, K., McPhilbin, M., Dunnett, D., Hunter-Brown, H., Yeo, C., Jebara T. & Slade, M. (2022) Recovery colleges characterization and testing in England (RECOLLECT): Rationale and protocol. BMC Psyuchiatry 22, 627.
- Health Service Executive, (n.d.) Advancing Recovery in Ireland: A Guidance Paper on Implementing Organizational and Cultural Change in Mental Health Services in Ireland. (Internet) Available at:

https://www.lenus.ie/bitstream/handle/10147/613321/ARIOrganisationalChangeGuidanceP aper.pdf?sequence=1&isAllowed=y, (Accessed 07th March 2023).

- Health Service Executive (2017) A National Framework for Recovery in Mental Health: A National Framework for Mental Health Service Providers to Support the Delivery of a Quality, Person-Centred Service. (Internet) Available at: https://www.getirelandwalking.ie/_files/recovery-framework.pdf, (Accessed 25th July 2023).
- Health Service Executive (2018) Co-Production in Practice Guidance Document 2018-2020. (Internet) Available at: https://www.researchgate.net/publication/331596095_CO-PRODUCTION IN PRACTICE GUIDANCE DOCUMENT, (Accessed 26th July 2023).

Health Service Executive (2020) Resources to Support the Development and Implementation of Recovery Education 2020-2025. (Internet) Available at: https://www.hse.ie/eng/services/list/4/mental-health-services/mental-health-engagementand-recovery/recovery-education/recovery-education-resources.pdf, (Accessed 07th March 2023).

- Health Service Executive (2020a) Toolkit to Support the Development and Implementation of Recovery Education 2020-2025. (Internet) Available at: https://www.hse.ie/eng/services/list/4/mentalhealth- services/mental-health-engagement-and-recovery/recovery-education/recoveryeducation- toolkit.pdf, (Accessed 07th March 2023).
- Health Service Executive (2020b) Peer Support Distance Working: Guidance on a Model of Peer Support Working during the Covid-19 Pandemic. (Internet) https://www.hse.ie/eng/services/list/4/mental-health-services/mental-health-engagementand-recovery/peer-support-distance-working.pdf, (Accessed 29th July 2023).
- Health Service Executive (2023) Recovery Education. (Internet) Available at: https://www.hse.ie/eng/services/list/4/mental-health-services/mental-health-engagementand-recovery/recovery-education/, (Accessed 28th July 2023).
- Hung, L. S. (2003) The SARS epidemic in Hong Kong: What lessons have we learned? Journal of the Royal Society of Medicine 96(8), 374-378.
- Hunter, A., O'Brien, A., Dwyer, D., Hunt, A. & Murphy, L. (2022) A Co-Created Multi-Method Evaluation of Recovery in Ireland. University of Galway.
- Jennings, J. (2023) AI in Education: The Bias Dilemma. (Internet) Available at: https://www.esparklearning.com/blog/get-to-know-ai-the-biasdilemma#:~:text=The%20same%20cultural%20issues%20that,and%20potentially%20amplifies)% 20the%20bias. (Accessed 22nd October 2023).
- Kapur, S. (2015) Andragogy: The adult learning theory. Indian Journal of Adult Education 76(2), 50-60.
- Kellerman, J.K., Hamilton, J.L., Selby, E.A. & Kleirman, E.M. (2022) The mental health impact of daily news exposure during the COVID-19 pandemic: Ecological momentary assessment study. JMIR Mental Health 9(5), e36966.
- Kelly, B. (2022) in Search of Madness: A Psychiatrist's Travels through the History of Mental Illness. Gill Books.

- Mabe, P. A., Rollock, M. & Duncan, G. N. (2016) Teaching Clinicians the Practice of Recovery-Orientated Care. in Handbook of recovery in inpatient psychiatry. (pp. 81-97) Springer International Publishing.
- Mannion, T. (2023) Third -Level Students Facing 'Brutal' Housing Situation. (Internet) Available at: https://www.rte.ie/news/education/2023/0817/1400162-student-accommodation-galway/, (Accessed 22nd October 2023).
- Meddings, S., McGregor, J., Roeg, W. & Shepherd, G. (2015) Recovery colleges: Quality and outcomes. Mental Health and Social Inclusion 19(4), 212-221.
- Melnyk, B. M., Fineout-Overholt, E., Stilwell, S. B. & Williamson, K. M. (2009) Igniting a spirit of inquiry: An essential foundation for evidence-based practice: How nurses can build the knowledge and skills they need to implement EBP. American Journal of Nursing 110(1), 51-53.
- Naslund, J. A., Grande, S. W., Aschbrenner, K.A. & Elwyn, G. (2014) Naturally occurring peer support through social media: The experiences of individuals with severe mental illness using YouTube. PLoS ONE 9(10), e110171.
- National Geographic, (2023) Epidemic. (Internet) Available at: https://education.nationalgeographic.org/resource/epidemic/, (Accessed 29th July 2023).
- Norris, M., Kelleher, J. & Bwalya, J. (2021) Digital Exclusion and E-Government in Ireland: A Citizens Information Perspective. (Internet) Available at: https://www.citizensinformationboard.ie/downloads/social_policy/social_policy_digital_exclu sion_june2022.pdf, (Accessed 29th July 2023).
- Norton, M. (2022) Co-Production in Mental Health: Implementing Policy into Practice. Routledge.
- Norton, M.J. (2022a) More than just a health care assistant: Peer support working within rehabilitation and recovery mental health services. Irish Journal of Psychological Medicine 1-2.
- Norton, M.J. (2022b) Co-production and mental health service provision: A protocol for a scoping review. BMJ Open 12, e058428.
- Norton, M.J. (2021) Co-production within child and adolescent mental health: A systematic review. International Journal of Environmental Research and Public Health 18, 11897.
- Norton, M.J. (2023) Peer support working: A question of ontology and epistemology. International Journal of Mental Health Systems 17, 1.
- Norton, M.J. & Cuskelly, K. (2021) Family recovery interventions with families of mental health service users: A systematic review of the literature. International Journal of Environmental Research and Public Health 18, 7858.
- Norton, M.J. & Flynn, C. (2021) The evidence base for Wellness Recovery Action Planning (WRAP): A protocol for a systematic literature review and meta-analysis. International Journal of Environmental Research and Public Health 18, 13365.
- Norton, M.J., Griffin, M., Collins, M., Clark, M. & Browne, E. (2023) Using autoethnography to reflect on peer support supervision in an Irish context. The Journal of Practice Teaching and Learning 21(2), 67-87.
- O'Connor, K., Wrigley, M., Jennings, R., Hill, M. & Niazi, A. (2020) Mental health impacts of COVID-19 in Ireland and the need for a secondary care mental health service response. Irish Journal of Psychological Medicine 27, 1-9.
- O'Leary, K., Bhattacharya, A., Munson, S.A., Wobbrock, J.O. & Pratt, W. (2017) Design Opportunities for Mental Health Peer Support Technologies. (Internet) Available at: https://dl.acm.org/doi/10.1145/2998181.2998349, (Accessed 29th July 2023).
- Perkins, R., Meddings, S., Williams, S. & Repper, J. (2018) Recovery Colleges 10 Years On. (Internet) Available at: https://imroc.org/wp-content/uploads/2022/04/ImROC-Recovery-Colleges-10-Years-On.pdf, (Accessed 26th July 2023).
- Puolakka, P. & Van De Steene, S. (2021) Artificial intelligence in prisons in 2030: An exploration on the future of AI in prisons. Advancing Corrections Journal 128-138.
- Price, M., Legrand, A.C., Brier, Z.M.F., van Solk-Cooke, K., Peck, K., Dodds, P.S., Danforth, C.M. & Adams, Z.W. (2022) Doomscrolling during COVID-19: The negative association between daily social and traditional media consumption and mental health symptoms during the COVID-19 pandemic. Psychological Trauma 14(8), 1338-1346.
- Read, J. (2013) Childhood Adversity and Psychosis. in Models of Madness: Psychological, Social and Biological approaches to psychosis. (pp. 246-275.) Routledge.

- Ruiu, M.L., Ragnedda, M., Addeo, F. & Ruiu, G. (2023) Investigating how the interaction between individual and circumstantial determinants influence the emergence of digital poverty: A postpandemic survey among families with children in England. Information, Communication & Society 26(5), 1023-1044.
- Seah, K.T.M. (2020) COVID-19: Exposing digital poverty in a pandemic. International Journal of Surgery 79, 127-128.
- Van Dokkum, N (2005) Nursing law for Irish students. Gill & Macmillan.
- Verity, R., Okell, L. C., Dorigatti, I., Winskill, P., Whittaker, C., Imai, N., Cuomo-Dannenburg, G., Thompson, H., Walker, P. G. T., Fu, H., Dighe, A., Griffin, J. T., Baguelin, M., Bhatia, S., Boonyasiri A., Cori, A., Cucunuba, Z., Fitzjohn, R., Gaythorpe, K., Green, W., Hamlet, A., Hinsley, W., Laydon, D., Nedjati- Gilani, G., Riley, S., van Elsland, S., Volz, E., Wang, H., Wang, Y., Xi, X.,Donnelly, C.A., Ghani, A. C. & Ferguson, N. M. (2020) Estimates of the severity of coronavirus disease 2019: A model -based analysis. The Lancet Infectious Diseases Advanced online publication.
- Wen, J., Aston, J., Liu X. & Ying, T. (2020) Effects of misleading media coverage on public health crisis: A case of the 2019 novel coronavirus outbreak in China. Anatolia Advanced online publication.
- Whitley, R., Shepherd, G. & Slade, M. (2019) Recovery colleges as a mental health innovation. World Psychiatry 18(2), 141-142.
- Wittmann, F.G., Zulke, A., Pabst, A., Luppa, M., Thyrian, J.R., Kastner, A., Hoffmann, W., Kaduszkiewicz, H., Dohring, J., Escales, C., Gensichen, J., Zollinger, I., Kosilek, R.P., Wiese, B., Oey, A., Konig, H-H., Brettschneider, C., Frese, T. & Riedel-Heller, S.G. (2023) COVID-19 government measures and their impact on mental health: A cross-sectional study of older primary care patients in Germany. Frontiers in Public Health 11, 1141433.
- World Health Organization (2020) Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). (Internet) Available at: https://www.who.int/docs/defaultsource/coronaviruse/who- china-joint-mission-on-covid-19-final-report.pdf, (Accessed 28th July 2023).
- World Health Organization (2023) WHO Coronavirus (COVID-19) Dashboard. (Internet) Available at: https://covid19.who.int, (Accessed 28th July 2023).
- Xiao, X., Song, H., Sang, T., Wu, Z., Xie, Y. & Yang, Q. (2021) Analysis of real-world implementation of the biopsychosocial approach to healthcare: evidence from a combination of qualitative and quantitative methods. Frontiers of Psychiatry 12, 725596.
- Yoeli, H., Ryan, A., Hensby, C., Hambermehl, F., Burton, S. & Sin, J. (2022) Recovery in mind: A recovery college's journey through the COVID-19 pandemic. Health Expectations 25(6), 3275-3286.

AI IN EDUCATION: A NEW SOCIAL *DIS*ORDER TO THE SOCIAL AND POLITICAL DISCOURSE OF 'WOKE' IN PK-20 EDUCATION

Zakia GATES^{*}

ABSTRACT

Discourse in PK-20 educational contexts has become a trending topic across various social media platforms and news outlets. Educators are now the implied enemy of democracy along with other implied enemies such as the term "wokeness," critical race theory, and books about diversity, equity, and inclusion. These trending topics in PK-20 education disrupted social injustice agendas where implied fears of social changes to disbar oppressive systems have challenged power structures to rethink, redesign, and restructure who, how, and what may replace human consciousnesses in education and possibly human existence in the field of education. One implication of this implied fear of social change may be attributed to culturally responsive and sustaining pedagogies educators and teacher candidates in PK-20 spaces use to enhance the social and political consciousness of students from diverse backgrounds in classrooms. Scholars and researchers of PK-20 education argue that using culturally responsive, relevant, and sustaining pedagogies humanizes pedagogical practices and how we explore curricula content and resources in these spaces. Additional implications of humanizing our practices as a counter to Artificial Intelligence (AI) could lead to empathy, respect, and value of human existence and could promote human sustainability in PK-20 education in a global society. Without this, society may continue its path of repeated efforts of a Holocaust, as argued by author and activist James Baldwin in his article "A Talk to Teachers" in 1963. However, with a new form of educating PK-20 students through Artificial Intelligence (AI), the ways of humanizing pedagogy and the replacement of human intelligence, thinking, and thought processes could become obsolete in PK-20 spaces. This could result in societal and educational contexts where empathy, value, and respect become the enemy of human autonomy and human sustainability. Lastly, this could also result in prior and post-knowledge human acquisition as second nature to an assembled machine of algorithmic magic spells on the human psyche.

Introduction: Ai's Mysterious Evolution

From Grammarly to Siri to Alexa, Artificial Intelligence (AI) has evolved into a trending topic across global platforms. Even toys from the '80s, such as Teddy Ruxpin shaped an understanding of Artificial Intelligence (AI). The 21st-century version of Artificial Intelligence (AI) evolved into more unique names such as ChatGPT and Dell e-2. It is the new socially constructed concept that has become the recent trending topic of 2021 and 2023. Some may argue that the use of Artificial Intelligence (AI) as a secondary knowledge base is sustainable to the human psyche of critical thinking and critical transformations, while others argue Artificial Intelligence (AI) could be used as an advantage to

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erase human sustainability, human productivity, and human intelligence (Rahman, 2021). Images on social media show Artificial Intelligence (AI) and its usage to create new human beings that society may assume actually exist (Frew, 2023). The most compelling evidence of humans that may not exist is the generative technology of Dall-e2, a form of AI where images can be created through the AI language (Kremer, 2023). to explain further, two people, one notable historical figure, Dr. Martin Luther King Jr., and one actor, Tom Hanks, supported the use of Dall-e2 (AI). Figure 1.1 shows Dall-e2 used to alter Tom Hanks appearance to resemble Dr. Martin Luther King Jr. for the role of the notable figure in a new Netflix movie (Frew, 2023).

Figure 1.1 "Is Tom Hanks Playing Martin Luther King? MLK Movie Explained" (Source: https://www.dexerto.com/tv-movies/tom-hanks-mlk-netflix-martin-luther-king-movie-explained-



The generative technology used Tom Hanks' race and the biological facial features of Dr. Martin Luther King Jr. as a very fair-skinned version of Dr. Martin Luther King Jr. One could argue that the generative technology of Dall-e2 serves the purpose of erasing the existence of Dr. Martin Luther King Jr. while others could argue the purpose of Dall-e2 as a detriment to alter facts of history for generations beyond our own. Even though the movie will never come to production, the very thought of altering someone's appearance is concerning. One possible implication behind altering the historical accounts of one notable

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figure could be the social injustices Dr. Martin Luther King Jr. addressed in his "I Have a Dream" speech when he declared the "fierce urgency of now," which spoke truth to powerful forms of oppressive systems. The induction of lawmakers' "anti-CRT" and "anti-WOKE" ideology to an implied indoctrination of PK-20 students' understanding and misinformation of historical narratives, the use of Artificial Intelligence (AI) and Dall-e2 adds to an agenda to eradicate Diversity, Equity, and Inclusion (DEI) initiatives. Furthermore, AI, along with Dall-e2, may add to the agenda of obsolete critical thinking and equitable transformative PK-20 spaces where ideas and different perspectives are exchanged using rational thought. Hooks (1994) argued that the centralized purpose of education is to challenge social, political, and cultural inequities, enhance levels of critical consciousness, and liberate the minds of current and future generations. Yet, the mystery of Artificial Intelligence (AI) in education remains unsolved, along with understanding human evolution. Inquisitions of the development of the internet often surface surrounding the summation of AI's existence in PK-20 spaces where large amounts of ideas are exchanged in the public sphere, yet these questions remain absent of authentic answers. For this chapter, a review of the literature argues that AI has advantages in PK-20 education spaces while others argue its disadvantages as a disruption to social justice in PK-20 spaces. The chapter proposes Artificial Intelligence (AI) as a disruptor to the social construct of being WOKE if used ineffectively. I argue that Artificial Intelligence (AI), specifically Dall-e2 (visual imagery), is used as a way to erase the existence of BIPOC communities and their experiences in history. I further argue that the use of AI will hinder and disrupt social justice in PK-20 educational spaces. This chapter presents different angles on Artificial Intelligence (AI) in PK-20 educational contexts as a new social disorder to the disruption of being WOKE and critically conscious in the 21st century and beyond. Another purpose for this chapter purports a review of the literature surrounding Artificial Intelligence (AI) in education in order to address the social and political contexts where the social discourse of WOKE adds to the implied enemy of PK-20 democracy. in other words, using the term WOKE, coined by the African American community, describes an informed awareness of social injustices, social inequities, and social inequalities (Alfonseca, 2023). The objectives of the chapter are to (1) Identify the advantages and the disadvantages of Artificial Intelligence (AI) in PK-20 education. (2) Determine the culturally responsive, relevant, and sustaining frameworks for using Artificial Intelligence (AI) in PK-20 education. (3) Explore Howard Gardner's Multiple Intelligence (MI) theory as it relates to Artificial Intelligence (AI) in PK-20 education. (4) Discuss the social justice and/or social injustice to critical thinking in PK-20 education.

Music, TV, and Film- The Universal Languages of Artificial Intelligence

Music as a universal language creates subliminal where ideas and philosophies about the existence of humanity and human sustainability are exchanged globally. Music is a public platform that penetrates through sound waves and cyberspace, where society is able to unpack its understanding, meaning, and relation to fiction and reality. A few songs that hit the airways in the 80s implied fictional and real stories where the question of human existence and human sustainability was paramount. These ideas and questions of humans and human intelligence surfaced as a fear of the unknown but also a question of whether the lack of human intelligence was necessary. Part of this inquiry came in the form of songs during the 1980s, which flourished the sound waves across radio stations nationally and internationally. Songs such as Mr. Roboto by the musical group Styx. The group's repetitive chant from the song - "Domo arigato Misuta Robotto" became an international success, and the Japanese phrase ruled the language of the United States of America. The social and political climate of the 1980s centered around the AIDS epidemic, the war on drugs, and education. This social and political climate of this time evoked a sense of Kairos among many musical artists and filmmakers. This sparked a musical and media content frenzy filled with conscious or "woke" levels of the world. The song by Styx surfaced on the music charts in 1983 during the Regan administration but also during the inception of the education report, A Nation at Risk. A Nation at Risk summarized the trending system of deprivation for PK-12 education. The education report was created as a way to fulfill one of the purposes of the United States Department of Education, which is to ensure the academic student achievement needed for global competitiveness. Data collected from several different sources, such as the former Secretary of Education, the US Department of Education, and The National Commission on Excellence in Education, reported issues pertaining to the academic performance of students compared to other neighboring countries. Out of this report, two such findings revealed, "17-year-olds do not possess the 'higher order' intellectual skills we should expect of them" and "Nearly 40% cannot draw inferences from written material" (A Nation at Risk, 1983, p. 11). The song Mr. Roboto and its key verses, "I've got a secret I've been hiding under my skin, my heart is human, my blood is boiling, my brain is I.B.M, so if you see me acting strangely, don't be surprised" (Deyoung, 1983) evoked a strong sense of Kairos due to the timeliness of the song, the verses, and the refrain. Further, the song's timeline also evoked a sense of logos where the state of American education was questioned by the political and social climate of the 1980s. This was a time when students' sense of intellectual consciousness and cognitive processes might become obsolete with the induction of Artificial Intelligence (AI). The song speaks to the very nature of human existence, living as soulless mannequins as a disruption to being "WOKE" while contributing more to an academic holistic disorder. The use of AI may have its advantages and disadvantages to the modern world but in particular to the human psyche of intelligence. Other forms of media, such as movies, also showed society a future view of what human intelligence or lack of human autonomy of intelligence might have on the world. Movies of the 70s and 80's implied the use of AI as an advantage to disrupt human intellectual autonomy. For instance, Ridley Scott's 1979 production of Alien purported a paradigm for the communication of a computerized and digitized version of Artificial Intelligence (AI) called the Mothership. American actress Sigourney Weaver's role as Ripley inquires more information regarding the status of the spaceship when trying to escape the jaws of the Alien. Weaver, like Ripley, furthered the use of the AI system as a means to disrupt human intelligence or to disrupt the dependency of human autonomy on the conscious awakening or the counternarrative to the Enlightenment period of new thought centuries ago. Furthermore, more recent media content, such as NBC's Chicago Med, addressed the use of Artificial Intelligence (AI) or, more so, "2.0 Technology," as noted by the episode, showing the use of asking AI for assistance and guidance through major surgeries (Chicago Med, 2023). Although fictionally based, the episode uses "2.0 Technology" through hologram manipulation to assess and evaluate whether the surgery will or will not work (Chicago Med, 2023). A potential danger in using AI in healthcare would be a question of the credentials and knowledge of the medical professional. Rahman (2021) emphasized that AI could hinder the autonomy and intellectual knowledge of medical professionals by "reducing brain usage caused by depending overtly on AI systems" (p. 3). Rahman's inquisitive examination of healthcare drives us to challenge the very knowledge of AI and how it is used throughout the medical profession, but more so for an industry purported to prepare our medical professionals - PK-20 education. I argue that the use of AI, even in the field of medicine, as a guide and director for surgery, questions the very idea of the human intellect, human training and human skills, and human creativity, where trust factors of medical professionals will decrease significantly. Patient and doctor mistrust have been an issue for centuries but added features to the mistrust from the 2020 global pandemic of COVID-19 being the "Democratic new hoax," and the skepticism of masks only added to the mistrust of medical professionals in addition to AI (Victor et al., 2020; NBCUniversal News Group, 2020; Rahmar, 2021). Therefore, where does this leave society, but in particular PK-20 educators regarding critical thinking and foundational development of ideas are the new enemy of social and political democracy. Fear of the unknown of a human replacement should further persist in the social and political discourse to ensure that human intelligence and the human sustainability of conscious, empathetic transformations in education remain paramount. Additionally, this persistence to further the discourse of AI should propel educators, scholars, and researchers to disrupt the slumber of social injustices of lawmakers trying to

dismantle humanizing pedagogy in PK-20 education. I further argue that educators should explore the advantages and the disadvantages of Artificial Intelligence (AI) in education in order to examine how implied fabrications of various algorithms may disrupt critical thinking yet could have ethical implications for students with special needs and families who choose to homeschool when a Free and Appropriate Public Education (FAPE) is not equitable to students' holistic development. Pondering questions about Artificial Intelligence (AI) linger in private and public sectors, including PK-20 spaces. These inquiries into the relevancy of Artificial Intelligence (AI) or the purposes behind its development challenge us to consider the reliability and validity in a social and political climate where "WOKE" is charged as the enemy of a democratic society. The purpose of AI also confronts society to evaluate ideas of cultural relevant, sustaining and responsive algorithms among PK-20 learners where language variations and instructional content and practices across cultures become erased in societal and educational contexts.

AI Defined: A Review of The Literature

Artificial intelligence (AI) is a concept often questioned on the rationale of thoughts and behaviors in relation to human existence and human sustainability. Artificial intelligence (AI) is defined as the construction of ideas to assemble machines to act in ways using thought and behavioral processes which navigate to find variables within an environment (McCarthy et al., 1955; Rahman, 2021). By comparison, the definition of Artificial Intelligence (AI) asserts the 1940 Disney film Pinocchio assembling a puppet commanded by the puppeteer to think, behave, and act in ways farther from human capability. This implied perfection depends on the machine's algorithmic capacity to recall relevant variables from the environment of cyberspace (Rahman (2021). Rahman (2021) noted the possible non-existence of humans through an imagined scenario of a new company where he proposed that a new company could employ a "fully automated service architecture" where there is no use for human labor (p.1). The use of a "fully automated service architecture" would rank superior for large and small companies over the use of human labor, which is predisposed to "emotion, fatigue, and sickness" (Rahman, 2021, p. 1). Rahman's analysis of AI as a way of human takeover shows the goals and objectives of adopting automated systems as a cost-effective measure against paid time off for sicknesses, paid time off for emotional distress, and paid time off for fatigue. Other reasons included automated systems as highly productive and a necessity to run businesses (Rahman, 2021). However, Rahman's analysis and other scholars of AI scholarship also address the benefits of using AI where data power can exceed the human psyche. Selwyn (2022) emphasized that the use of AI in education is a cautionary note where claims of confidence for its use are "uncertain, unpredictable, and essentially unknowable" (p. 620). Selwyn's assertion is further from the false narrative that AI will take over human existence, human thoughts, emotions, and sustainability. Since education needs some aspects of politics, Selwyn (2022) pointed out that the political discourse of AI in education is closer to being correct than the other claims that AI will be the "game changer" in educational spaces (Richardson & Clesham, 2021, p.1). The assumption that AI will be the "game changer" questions how and to what extent "game changer" is defined in PK-20 spaces where theoretical and conceptual frameworks of culturally relevant, responsive, and sustaining pedagogies are used extensively among PK-20 teachers. It also questions the lens used to create algorithms using ChatGPT for the content creation of historical narratives. As mentioned earlier, using the generative technology of Dall-e2, where images are created or altered using AI language, supports the idea of the "game changer" argued by Richardson and Chelsam. These questions the future of curricula and how curriculum specialists implement the "game changer" narrative when exploring how and to what extent marginalized experiences are included. Dall-e2 could also revert education to the traditional method of how educators explored curricula that theorist Paulo Freire strongly opposed. to further emphasize, using Dall-e2 in education questions the lens that determines what is equitable and inequitable. Therefore, until an accurate account of the term "game changer," as quoted by Richardson and Clesham, is clearly defined, the assumption of an inequitable lens of algorithms through AI will remain. Selwyn (2022) further argued the "game changer" phrase by including remaining remarks about Artificial Intelligence (AI) as quoted by Richardson and Clesham and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Richardson and Clesham (2021) and UNESCO (2019) also pointed out that AI could have the "potential to address some of the biggest challenges in education today" (p.1). What challenges are Richardson and Chelsham addressing today in education for this "game changer" of Artificial Intelligence (AI) to seize in PK-20 spaces? Are these challenges implications of systemic issues in education and how these issues influence and impact policies and mandated regulations across school districts and the smaller canons of PK-20 spaces? If we argue from the systemic issue, one could assume the Supreme Court decisions on education and the impact in PK-20 spaces today as a potential "game changer" to "address some of the biggest challenges in education today" (Richardson & Chelsham, 2021, p. 1). The cultural and social capital phenomena of the Supreme Court decision of Brown v. Board of Education of Topeka (1954) and Brown v. Board of Education (1955) racialized the attempt to deem segregation of public education unconstitutional while enacting measures to desegregate at "all deliberate speed" (Noblit & Mendez, 2008; Armor, 2006). This became a pivotal point in American history as educational equity became the focal point to the centrality of educational outcomes for students in PK-12 spaces. Equally important, the Supreme Court decisions of 1954 and 1955 proposed to ensure

the consistency of educational equity across public education. Therefore, the assumption that Artificial Intelligence (AI) in education will likely be the "game changer" in addressing educational challenges today (Richardson & Chelsham, 2021, p.1; UNESCO, 2019) further pushed the narrative that equity in education remains a huge challenge in PK-20 spaces, even with the induc-tion of both Supreme court decisions of 1954 and 1955. From the larger context of education, such as Brown v. Board of Education of Topeka (1954), Richardson and Chelsham's claims would be feasible. While Richardson and Chelsham never identified educational equity as "the biggest challenges in education today," then how and to what extent will Artificial Intelligence (AI) likely be the "game changer" in PK-20 spaces (p.1)? With this intention, if Richardson and Chelsham (2021) addressed educational inequity as one of the "biggest challenges in education today" and also acknowledged that inequities, in general, are overlooked, then this would enhance the validity and credibility of the "game changer" to use Artificial Intelligence (AI) in PK-20 spaces in order to disrupt social injustices of educational outcomes (p.1). to explain further, if Artificial Intelligence (AI) was a searing commodity during both Supreme Court decisions of 1954 and 1955, and algorithms suggested quantitative and qualitative methodologies to obtain and sustain equitable funding to expedite equitable resources, equitable learning modalities, and equitable practices for Free and Appropriate Public Education (FAPE), then the purpose of AI's algorithms could magically detect, identify, and discover ways to sustain PK-20 education. On the contrary, equity has been a long-withstanding issue of education "today," yesterday, and probably will continue. This was noted by civil rights activist and author Dr. Martin Luther King Jr., who asserted that Brown v. Board of Education of Topeka (1954) was a historical event but has "not made history" (King, 1967, p. 11). in summary, Artificial Intelligence (AI) in education may or may not be the "game changer" of social and political equitable capital in PK-20 spaces, nor may it change equitable educational out-comes. Depending upon the development of algorithms and variables within cyberspace, AI will only understand a single-axis view of equity and its impact and influence on public education if the algorithmic lens is not culturally sustaining and relevant in PK-20 education.

Advantages and Disadvantages of AI in PK-12 Education Vs. Academic Integrity and AI Tools in 16-20 Education

Advantages to Artificial Intelligence (AI) usage in PK-20 spaces vary. These variations are the use of virtual assistants to specialized instruction in PK-12 spaces, to personalized learning management systems. Artificial Intelligence for specialized instruction in PK-12 spaces in particular, can generate assessments, content, and allow students to conduct inquiries of knowledge. Nahas (2023) described AI tools' purpose in education as a way of measuring algorithms to assess learning progression of students. This implies that existing
mental structures are in place in preparation for the integration of AI knowledge acquisition. While AI tools are used to assess learning progression places advantages over AI, and prior knowledge acquisition remains paramount in PK-12 spaces, other inquiries into the integrity of AI tools on college campuses remain controversial. Academic integrity and AI tools are highlyseasoned commodities of discussion in faculty development sessions on university campuses nationwide. External tools in learning management systems provide open access for students to use AI tools, but in particular ChatGPT, to assist with course lectures, assignments, understanding of course content, and discussion posts. According to the International Center for Academic Integrity (2018), academic integrity "as a commitment to six fundamental values - honesty, trust, fairness, respect, responsibility, and courage" (p. 6). Truly the fundamental values of academic integrity across university campuses are an integral part of institutional culture and climate to maintain its sustainability. However, how and to what extent does academic integrity inform the culture and climate with regards to AI tools as primary ways or secondary ways to gain knowledge acquisition. While some argue AI tools, such as ChatGPT, as a quick, fast, and easy way -just as Google and Siri -to answer questions, others describe ChatGPT as a way to improve or enhance understanding of course content where "honesty, trust, fairness, respect, responsibility and courage" are practiced (Perkins, 2023; International Center of Academic Integrity, 2018, p. 1). Per institutional policies, plagiarism, as an aspect of academic integrity, regulates the probability of students infringing copyright of others material. For this purpose, academic integrity and ChatGPT, must harmonize to bring a balanced approach to maintaining the fundamental values of "honesty, trust, fairness, respect, responsibility, and courage" where the culture of initial knowledge acquisition, critical consciousness, and critical thinking - or staying "woke" is prevalent. to combat an implied social injustice to the erasure of critical thinking and critical consciousness in PK-20 spaces, but in particular university campuses, Perkins (2023) explored key aspects of academic integrity, academic misconduct, and ethical considerations as it relates to using "Large Language Models (LLMs)" through ChatGPT in digitized writing (p. 1). Large Language Models are AI language algorithms that generate larger data sets of information based on shorter input requests (Perkins, 2023). Perkins (2023) added that the evolution of these tools of AI in learning management systems to use "Large Language Models (LLM)" are able to "develop significant amounts of based-new text based on short input requests" (p. 3). Perkins (2023) implies that humanizing our pedagogy to further explore AI's benefits as an evolutionary way to co-exist in the college space. For this reason, Perkins (2023) contrasts two AI tools - Automated Paraphrasing Tools (APT) and Digital Writing Assistants (DWA) as useful tools for students to "transform one text into another" (Rogerson & McCarthy, 2017) and the other where

students can use to detect grammatical errors in essays to improve writing skills (Fritria, 2021). Examples addressed of this include Grammarly and Word Tune as being helpful and useful tools for students to improve writing. This is supported by the literature in two ways: (1) It is supported by Nahas (2023) as it relates to learning progression from content creation and assessments using AI tools (2). It is a key aspect to maintaining the culture of "woke" or critical thinking and critical consciousness. Furthermore, APT and DWA AI tools are beneficial for all students, but in particular, students who are identified as "English Foreign Learners (EFL)" (Perkins, 2023, p. 2). What is equally important for "English Foreign Learners (EFL)" as it relates to these AI tools for writing refinements, is the role educators play in guiding and directing their learners in ensuring that the probability of plagiarism remains low - centrally where institutional culture aims to sustain "honesty, trust, fairness, respect, responsibility, and courage" (Perkins, 2023, p. 2; *The International Center for Academic Integrity*, 2018, p. 1).

An added benefit to AI tools is the use of Perusall. Perusall is an external tool added to course learning management systems where students engage in critical in-depth discussions and collaborations from readings (Perusall, 2023). Perkins (2023) noted Perusall as a Digital Writing Assistant used to assess students' learning progression in course content. As an Assistant Professor of Education who teaches Multiculturalism, through the asynchronous modality, Perusall manages to use distinctive AI characteristics. These characteristics detect and record the percentage of students who completed submissions, it purports the number of minutes of student engagement, and detects whether students read half or the full readings posted by the instructor. Questions may loom as to how much surveillance is acceptable in generating this information, but these AI generating tools in Perusall help educators to assess how and to what extent student discourse is explored and synthesized. As an instructor new to Perusall, the experience ranges from beneficial to subtle challenges. One of those challenges is the idea that Perusall is the savior that lessens the chance of students using ChatGPT, while the other is staying abreast of students' responses to readings. A benefit using Perusall is that it aims to challenge students to think beyond the circumference of their awareness about Multiculturalism in a global society. For example, students assigned to readings on a weekly basis must read articles and annotate three high quality statements on the document. From there, students engage in discussions and collaborate on ideas with fellow peers. The way AI tools such as Digital Writing Assistant (DWA) works as it relates to student discourse in Perusall are through audits. This part of Perusall is quite unique because it flags inappropriate forms of discourse but also alerts educators about students' infringement of copyright issues from other students' replies. This allows AI to generate how the student will be evaluated based on the assignment through Perusall.

Though students may perceive Perusall as a way to improve writing, particularly in college and university spaces, the benefits of exploring students' forms of discourse on sensitive topics in Multiculturalism in a multicultural global society, harmonizes AI and our pedagogy. This supports the idea of sustaining a culture of critical thinking, social awareness, and critical consciousness similar to "woke" as part of the social and political discourse in PK-20 spaces.

Undoubtedly, AI tools such as APT, DWA - Perusall, used for content and assessment development gives assistance to educators to assess learning progression as a substantial improvement to college spaces (Perkins, 2023; Nahas, 2023), but AI tools should not replace critical thinking nor should it be an erasure of critical consciousness or the "woke" entity of human existence. Furthermore, these AI tools must be guided effectively for students' use in content discourse in order to sustain the culture of critical thinking and social awareness of the world. For example, Perkins (2023) argued that the "Large Language Models (LLM)" are used as language algorithms in AI to generate larger data sets of information based on shorter input requests. to prove or refute this claim, a shorter input request of the following was used - "Compare and contrast the similarities and differences among Gloria Ladson-Billings, Django Paris, and Geneva Gay. Your response must be 300 to 400 words maximum using APA 7th edition in text citation and reference page". Although the response generated similarities and distinctions among the scholars' work, what was absent from Perkins' claims of this language algorithm generated by AI are the number of words used for a shorter input request. in fact, there was no evidence of the Large Language Models providing APA in text citations or reference pages. However, inputting a request for APA through ChatGPT would be beneficial for students who are looking for an easier way for APA citation information. Another example of a shorter input request was taken directly from the course on Multiculturalism. Students were required to "review resources on the learning management system related to the history of Brown v. Board of Education (1954) and be able to articulate and debate the impact of segregation on today's students". The results from ChatGPT generated a lesson plan for educators to use to help students understand the impact of Brown v. Board of Education on student's today instead of providing specific examples and details regarding the impact of the Supreme Court decision for students' knowledge. Educators play an integral part when using AI tools to create learning environments where modeling good responses from ChatGPT and poor responses from ChatGPT is the priority.

AI and Assessment Validity and Reliability

As mentioned earlier, Nahas (2023) proposed a partial gap in the literature on Artificial Intelligence in education where explicit terms of "enhance" to learn-

ing were used, whereas learning progression was implied in other literature. in like manner, Poquet and De Laat (2021) noted AI tools in education as a way to "augment learning to support capability" (p. 1703). As the world evolves with new innovative trends, data collection is critical to learning and instruction in PK-20 education and other spaces where adult learning occurs. Data is the driving force for instruction in PK-20 education. However, data collection methodologies in the general workforce are also a vital purpose and advantage to Artificial Intelligence (AI), where learning is supported and augmented for professional development purposes (De Laat et al., 2020). By comparison, using data analytics through AI tools for workplace training and education can augment professional development through algorithm modification (Littlejohn, 2017). Questions still surface surrounding the reliability and validity of not only assessment generation (Nahas, 2021) but also questions the reliability and validity of the lens used in algorithm development that detects, identifies, and discovers. Poquet and DeLaat (2021) noted the benefit of Artificial Intelligence (AI) for human decision-making and problem-solving but implied an equity issue concerning the availability of reliable AI tools. Hypothetically, if Poquet and DeLaat (2021) implied the availability of reliable Artificial Intelligence (AI) tools for adult learning, then does this idea still question the reliability, validity, and availability of the equitable algorithms of AI tools for PK-20 spaces? Cope, Kalantzis, and Searsmith (2021) emphasized "binary calculations" of "human meaning" to assert questions surrounding the reliability, validity of AI tools for assessment generation (p. 1230). Cope et al. (2021) outlined four transpositions to correlate "binary calculations" to "human meaning" to imply a social justice or a social injustice to human meaning (p. 1230). Just to note, in reviewing the lexicon and the content of the four transpositions from the literature, a summation follows the table below. The understanding to explain the content of information proposed by Cope et al. was done without the use of an Artificial Intelligence (AI) component, ChatGPT, in order to prove or disprove Cope et al. relationship to human meaning.

Transposition	Summary
Namability	The purpose behind how and why learning management systems work. Nama- bility classifies the data from learning management systems (LMS) into "ontol- ogies" (Cope et al., 2021, p. 1233)
Calculability	The state of creating the algorithm which is subsequent to ontology (Cope et al., 2021)
Measurability	The concept is subsequent to ontology and calculability which involves content related material and students' understanding of the content material where

Table 1. (Source: "Artificial Intelligence for Education: Knowledge and its Assessment in AI-Enabled Learning Ecologies")

	facilitators "collect interpretable information about student learning" (Monte- bello, 2019; Cope et al., 2021, p. 1236).
Representability	The final concept subsequent to ontology, calculability, measurability that involves the graphics, text and images of evidence to student learning (Cope et al., 2021).

What this table shows is the method of using an AI-enabled system of an input and output process in order to read, interpret and visually represent a student's learning and learning progression. A fundamental question proposed in the literature is "How do binary calculations become human meanings?" (Cope et al., 2021, p. 1230). First, part of this process in PK-20 spaces, in this case in relation to Nahas claims, assessment generation, is the validity and credibility of content - the input that results in the student's learning progression - the output. This begins with "naming," synonymous with "coding" in qualitative research, where learning management systems use identifiable markers for content-related material (Cope et al., 2021). Cope et al.'s (2021) example of the name "Smith/smith" has no relation to any form of "human meaning" but instead an academic relationship to an occupation included in the text of students' reading (p. 1233). Another part of "naming" involves determining the roles of those involved in students' learning progress in PK-20 spaces (Cope et al., 2021, p. 1233). With "naming," "calculability" adds to the process of coding information in smaller and more intricate amounts of larger data sets of students' learning progression in PK-20 learning management systems. This involves using Artificial Intelligence (AI) as the backseat driver instead of the forerunner to create and analyze the larger data sets because of the costeffectiveness of completing the job (Cope et al., 2021). Rahmar's analysis of the cost-effectiveness of Artificial Intelligence (AI) is in accord with the claim presented by Cope et al. during the calculability phase. This informs PK-20 educators that "human meaning" and human necessities do have advantages when Artificial Intelligence (AI) is the backseat driver to larger data sets. This process takes a significant number of human neurons and mental structures to create and analyze large data sets at a salary close to statisticians. Comparatively, the "measurability" of Artificial Intelligence (AI) requires the interpretation of larger data sets (Cope et al., 2021). Tracking progress in PK-20 education spaces through an AI component uses "data sensors" to identify the continual learning progression of students (Cope et al., 2021, p. 1236). During the COVID-19 pandemic, when PK-20 spaces were strictly through online learning modalities, students within these spaces were given assessments via the learning management systems. The way to take an assessment from the comforts of students' homes was not only difficult but also an invasion of privacy. Cope et al. (2021) noted that the use of detectors to identify motions to track movements of the eyes to the number of keystrokes and clicks to measure student

engagement and collaboration can be well orchestrated in a "well-instrumented learning management system" (p.1236). Although this may be true and quite useful for students and teachers, it is argued that this way to measure learning progression could be a little extreme due to the constant surveillance of movements. Lastly, "representability" is the final transposition to show clear and valuable evidence of learning progression through an Artificial Intelligence (AI) component. Cope et al. (2021) indicated the different ways to view the learning progression as the final output of using an Artificial Intelligent way to generate assessments, which can be useful for families of students, specifically useful for families of students with different learning styles. However, are there multiple ways and approaches to calculate and measure learning progression using AI when students in PK-20 spaces have multiple intelligences? Aside from the PK-20 education space, Poquet and DeLaat (2021) further argued that workplace learning must align itself with the new ways of technology by understanding the use of data analytics of AI tools as a good social practice. By contrast, Poquet and DeLaat (2021) added that AI tools do not consider acquiring knowledge from individual learning.

Let's Get Ready to Rumble – AI Vs. MI

Poquet (2021) argued the use of AI tools in the workplace as a form of good social practice but acknowledged AI tools' failure to determine and consider knowledge acquisition of individual learning. of course, PK-20 educators and scholars of PK-20 education assert theory to practice methodologies to accommodate different learning styles and emphasize the use of different approaches to measuring intelligence. Dr. Howard Gardner, Developmental Psychologist, developed the theory of Multiple Intelligence, where intelligence is suggested as a multidimensional approach to learning. Gardner (1983) illustrated eight types of intelligence.

Table 2. Gardner's Theory of Multiple Intelligence (Source: "Gardner's Theory of Multiple Intelligences" https://www.verywellmind.com/gardners-theory-of-multiple-intelligences-

$2795161\#: \sim: text = Gardner's\%20 Multiple\%20 Intelligences \& text = Gardner\%20 first\%20 outlined\%20 history in the state of the state$
%20theory,different%20kinds%20of%20%22intelligences.%22)

Multiple Intelligence (MI)	Summary
Logical-mathematical	Strengths are: reasoning, problem solving, examining relationships (Gardner, 1983).
Bodily-Kinesthetic	Strengths are: dancing, sports, movements, control of motor skills (Gardner, 1983).
Musical	Strengths are: recalling song lyrics, singing, playing instruments, exploring patterns in music (Gardner, 1983).
Visual-spatial	Strengths are: putting puzzles together, assembling, interpreting maps and other visual aids, recognizing patterns (Gardner, 1983).

Linguistic-verbal	Strengths are: reading, writing, language (Gardner, 1983).
Interpersonal	Strengths are: understanding and relating to others, effective com- munication, creating positive relationships with others (Gardner, 1983).
Intrapersonal	Strengths are: knowledge of self, self-awareness, exploring and analyzing ideas, awareness of feelings and motivation (Gardner, 1983).
Naturalistic	Strengths are: sciences especially in relation to plants and animals, classify and categorize things, hiking, camping (Gardner, 1983).

Gardner's subjectivity of multiple intelligences does not determine whether any individual is more intelligent in one area compared to another person in another area (Snowman & McCown, 2015). However, the battle between nature-human intelligence versus machine-artificial intelligence in PK-20 spaces questions whether either can be effectively measured in a culturally responsive way. in general, Gardner's theory of Multiple Intelligence (MI) would oppose the single-axis way of acquiring and assessing intelligence through the Intelligent Quotient test (IQ), where cultural bias and inequity of resourceful information remain questionable. Part of Gardner's theory (1983) is the bodilykinesthetic, where individual intelligence displays strengths in motor skills, movements, and sports. As mentioned earlier, AI tools of virtual assistance can be useful to accommodate specialized instruction in special education. Wang (2021) pointed out the significance of virtual realities (VR) as a disruptor to technology and will be the next impactful trend to hit the market for most Internet users. As stated earlier, the example from Chicago Med and the "2.0 Technology ", these virtual realities, as it relates to Gardner's bodilykinesthetic subtext, challenge and informs us in PK-20 spaces to strongly consider how this will change the whole paradigm of education in the 21st century. If virtual realities can be used to educate potential candidates to teach physical education in PK-20 spaces, then how reliable and credible is the AI tool to accurately detect, discover, and identify ligaments, joints, and other parts of the body? Wang (2021) asserted that virtual reality technology (VRT) includes a step-by-step process to help distinguish joints and other parts through coordinates and other points of reference; the logistics of this process will not be included in this chapter. to put it differently, a VRT to identify, detect, and discover parts of the body for candidates of physical education is a good social practice, as noted by Poquet (2021), but the natural form of bodily-kinesthetic intelligence is no measure of a virtual reality or a virtual assistant. It is argued that the very things that were once considered innately human to do - such as human intelligence - are done by Artificial Intelligence (AI) (Roberts, 2018). to clarify, PK-20 students' natural intelligence will probably not be considered

when AI is the substitute for human learning. Indeed, AI tools can be used to measure human learning progression, as noted by Cope et al. (2021), but it questions the accessibility and availability of information and challenges PK-20 spaces to think about a possible cultural bias from one algorithm lens. Furthermore, PK-20 educators may assume the ideology to refer to AI tools as a way to assist what to use to tap into the Multiple Intelligences (MI) that all students possess.

For example, linguistically-verbal PK-20 students who have a natural inept intelligence to analyze lexicons and morphologies of language may see the advantage to using AI tools for points of reference only if PK-20 educators, with a social justice lens using culturally sustaining pedagogical frameworks, ensure the consistency of approaches to sustain and maintain their linguistic and verbal intelligence. Roberts (2018) noted that stories are written, and news reports are generated through AI tools in education spaces. This will not only be a challenge for PK-20 educators but also questions the accuracy of information of stories and news reports. in addition, Roberts (2018) asserts that AI tools only imitate what humans think and do; however, it seems to take over the spectrum of our society. Another example of this uses the subtext intelligence of mathematical-logical. AI tools can also be used and have been used for mathematical computations and other logistics for this content area. Therefore, where are we going as a society in PK-20 spaces, and what will our future generations think and do? However, there is a glimpse of hope. Roberts (2018) added that Gardner's example of interpersonal intelligence has not been mastered by Artificial Intelligence. This is where AI lacks in the department of emotional intelligence, where the understanding of others seems less than before. One point overlooked is two other forms of intelligence under Gardner's theory as added features that AI has not mastered, which are: (a) existential intelligence and (b) pedagogical intelligence (Roberts, 2018). However, with the socially constructed term "WOKE" in PK-20 education, which is deemed an enemy to GOP lawmakers, a pedagogical existentialism framework (WOKE) counters the status quo and social hierarchies of reason, thought, and transformation. in summary, natural cognitive building blocks and mental structures used to scaffold vital information in PK-20 education are the overall purposes of creating generations who will challenge the very inequities that bell hooks and others proposed. However, the use of AI tools in PK-20 education provides a one-scope and single-axis view of information that an existentialist would find detrimental to the human psyche.

Recommendations For PK-20 Educators

Education is the most powerful and largest movement in the world. It is a space where transformative culturally responsive teaching and learning challenges the status quo of dismantling hierarchies. It is also a space where learning to live amongst one another democratically is present. As a global movement, society continues to question - where is the great debater of this age? Other questions surface such as what would the great philosophers of centuries ago rely on as secondary methods of understanding the world, but in particular questions of education? What would happen with the absence of natural intelligence that becomes an environmental phenomenon in educational spaces? These philosophical questions are now the catalyst to social commentaries in PK-20 education, but in particular college campuses as it relates to potential issues and benefits surrounding AI tools. First, college campuses can aim to humanize pedagogy by inserting AI tools into their course regime. This starts with course syllabi which explicitly addresses not only academic integrity for the goal of "honesty, trust, fairness, respect, responsibility, and courage" (International Center for Academic Integrity, 2018), but also academic misconduct of using AI tools as a primary instead of a secondary measure. Next, college campuses, in particular, must address the gap in teacher education programs where courses surrounding AI tools are absent. The earlier example addressed the assignment regarding Brown v. Board of Education (1954). Instead of AI tools providing information students would look for, the ChatGPT generated an entire lesson plan including learning objectives and day-to- day procedures to execute. in some cases, pre-service teacher candidates may elicit ChatGPT to generate lesson plans in teacher education programs if policies are not created to lessen that probability. The most important part of lesson plans for pre-service teachers is to create learning objectives that are content-centered, student-centered, and behavior centered - not generated from ChatGPT. Therefore, staff, faculty, department chairs and deans should collaborate to create policies surrounding AI tools by listing what it should and should not be used for. Also, policies that include consequences for academic misconduct must play an integral part in the dissemination of generating material from AI tools.

Educators in PK-12 spaces must set the groundwork of norms and expectations of classrooms before introducing and executing content. PK-12 teachers must also include the potential issues and benefits of using AI tools where students can explore the angle on why it is good to be stuck. Students' sense of feeling stuck on a topic or issue presented by PK-12 teachers challenges learners to think first before using AI tools. This could bring that harmony between humanizing our pedagogy and AI tools as secondary attempts as argued by Perkins. Other recommendations include: (1) Training and discussions during faculty development (16-20) and professional development (PK-12) with a focus on shorter input requests to generate information from ChatGPT as a secondary method for students instead of an initial search. (2) Explicit guidelines using AI tools such as ChatGPT appropriately and responsibly. (3) Discuss the benefits of AI, but also model an effective usage of the algorithms. (3) For cost effectiveness, elicit teachers, faculty, and/or staff who have conducted research on the advantages and pitfalls of using ChatGPT and other AI tools instead of seeking outside consultants.

Conclusion

In conclusion, the literature addresses the advantages, benefits, and challenges of ChatGPT AI tools, but further questions surrounding its overall purpose in PK-20 education remain unanswered. The literature supports and even refutes some ideas of AI tools as strategies to counter traditional teaching and learning (Nahas, 2023). Broad scopes of the literature should be taken into consideration for PK-20 education and AI tools, however, missing elements include the validity and reliability of assessments generated through AI tools. At the same time, the emphasis on AI in education to enhance and assess learning progression was absent from the literature as it relates to statewide assessments. Lastly, inquiries as to why students may resort to using AI tools initially remain unknown. to answer this, educators should revisit best practices to how assignments are created. The lens to create projects and assignments in course content should be resistant to rubbish instead of susceptible to it. to put this another way, educators must create assignments that are resistant to the bottom tier of higher-order thinking skills in order to prohibit the use of AI tools as an initial go-to for knowledge. Educators must also create learning environments where academic misconduct - as it relates to possible plagiarism - is obsolete. Artificial intelligence (AI), if misused, could be a deterrent to the socially constructed form of WOKE or critical intellectual consciousness. This could be a part of the disorder in the social and political discourse of education, where a new form of intelligence, that is rather imitated, is generated through the authenticity of reasoning. As AI tools become the imitator to human production, human sustainability, and human necessity, human intelligence may gear up for replacement to emotional intelligence. to summarize, the literature filled some gaps in where terms such as enhanced learning progression were absent. A limitation to some of the literature surrounding AI tools in education, coupled with the examples of the types of assessment generation, was the absence of the reliability and validity of assessment scores. Another limitation of the literature summation was the absence of culturally responsive and culturally sustaining algorithms of AI tools in education which could incur bias and blind educators of accuracy in scoring. On the one hand, AI can be a transformative culturally responsive social justice concept aimed to deter the status quo of traditional education, or AI could disrupt social justice to critical thinking, exploration, and experiential learning in PK-20 education. to sum up, educators and students using AI tools responsibly marry the concepts between algorithms and humanizing pedagogy and humanizing learning.

References

- Alfonseca, K. (2023). What does "woke" mean and why are some conservatives using it? ABC News. https://abcnews.go.com/Politics/woke-conservatives/story?id=93051138
- Armor, D. J. (2006). Brown and black-white achievement. Academic Questions, 19(2), 40–46. https://doi.org/10.1007/s12129-006-1014-8
- Beijing consensus on AI and education. Unesdoc.unesco.org. (2019). https://unesdoc.unesco.org/ark:/48223/pf0000368303
- Brandt, M., Wolf, D., & Haas, D. (2023, January 11). It is what it is until it isn't. *Chicago med.* episode, Chicago, IL; NBC.
- Clemson University. (2018, July 26). *The fundamental values of academic integrity*. International Center for Academic Integrity. https://academicintegrity.org/images/pdfs/20019_ICAI-Fundamental-Values_R12.pdf
- Cope, B., Kalantzis, M., & Searsmith, D. (2021). Artificial intelligence for education: Knowledge and its assessment in AI-Enabled learning ecologies. *Educational Philosophy and Theory*, 53(12), 1229– 1245. https://doi.org/10.1080/00131857.2020.1728732
- De Laat, M., Joksimovic, S., & Ifenthaler, D. (2020). Artificial Intelligence, real-time feedback and Workplace Learning Analytics to support in situ complex problem-solving: A commentary. *The International Journal of Information and Learning Technology*, 37(5), 267–277. https://doi.org/10.1108/ijilt-03-2020-0026
- Fitria, T. N. (2021). Grammarly as AI-powered English writing assistant: Students' alternative for writing English. *Metathesis: Journal of English Language, Literature, and Teaching*, 5(1), 65. https://doi.org/10.31002/metathesis.v5i1.3519
- Frew, C. (2023). Is Tom Hanks playing Martin Luther King? MLK Netflix movie explained. Dexerto. https://www.dexerto.com/tv-movies/tom-hanks-mlk-netflix-martin-luther-king-movieexplained-2195023/
- Gardner, H. (1983). Frames of mind the theory of multiple intelligences. Basic Books.
- hooks, bell. (1994). Teaching to transgress: Education as the practice of freedom. Routledge.
- King, M. L. (1967). Where do we go from here? Chaos or community. Hodder and Stoughton.
- Littlejohn, A. (2017). Learning and work: Professional learning analytics. *Handbook of Learning Analytics*, 269–277. https://doi.org/10.18608/hla17.023
- McCarthy, J., Rochester, M. L., & Shannon, N. (1955). A proposal for the Dartmouth summer research project on artificial intelligence. *AI Magazine*, 27(4), 12–14.
- Nahas, E. (2023, February 21). *The use of AI assistants in learning*. eLearning Industry. https://elearningindustry.com/the-use-of-ai-assistants-in-learning
- NBCUniversal News Group. (2020, February 29). Trump calls coronavirus democrats' "new hoax." NBCNews.com. https://www.nbcnews.com/politics/donald-trump/trump-calls-coronavirusdemocrats-new-hoax-n1145721
- Noblit, G. W., & Mendez, J. C. (2008). Legacies of Brown versus Board: An introduction to the special issue. *The Urban Review*, 40(1), 1–4. https://doi.org/10.1007/s11256-007-0079-1
- Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: Chatgpt and beyond. *Journal of University Teaching and Learning Practice*, 20(2). https://doi.org/10.53761/1.20.02.07
- Poquet, O., & Laat, M. (2021). Developing capabilities: Lifelong learning in the age of AI. British Journal of Educational Technology, 1695–1708. https://doi.org/10.1111/bjet.13123
- Rahman, M. M. (2021). Should I be scared of Artificial Intelligence? Academia Letters, 1–5. https://doi.org/10.20935/al2536
- Richardson, M., & Clesham, R. (2021). Rise of the machines? the evolving role of AI Technologies in high-stakes assessment. *London Review of Education*, 19(1). https://doi.org/10.14324/lre.19.1.09
- Roberts, R. (2018, April 8). *A.I. and multiple intelligences*. Scribal Multiverse. https://www.scribalmultiverse.com/a-i-and-multiple-intelligences/
- Rogerson, A. M., & McCarthy, G. (2017). Using internet based paraphrasing tools: Original work, patchwriting or facilitated plagiarism? *International Journal for Educational Integrity*, 13(1). https://doi.org/10.1007/s40979-016-0013-y

- Selwyn, N. (2022). The future of AI and education: Some cautionary notes. *European Journal of Education*, 57(4), 620–631. https://doi.org/10.1111/ejed.12532
- Snowman, J., & McCown, R. R. (2015). Psychology applied to teaching. Wadsworth.
- Styx. (1983). Mr. Roboto. Dennis DeYoung, John Panozzo, Chuck Panozzo, James Young, and Tommy Shaw.
- Victor, D., Serviss, L., & Paybarah, A. (2020, October 2). in his own words, Trump on the coronavirus and masks. The New York Times. https://www.nytimes.com/2020/10/02/us/politics/donaldtrump-masks.html
- Wang, Y. (2021). Physical education teaching in colleges and Universities assisted by virtual reality technology based on Artificial Intelligence. *Mathematical Problems in Engineering*, 2021, 1–11. https://doi.org/10.1155/2021/5582716

REFLECTIONS OF THE VIRTUAL WORLD ON EDUCATION AND PRACTICE EXAMPLES

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Introduction

Technology has an effect on the form of education. Furthermore, the in-depth, sustainable development of education requires a wider application of modern information technology. The development of science and technology encourages educators to continuously explore and apply new technologies, methods and teaching practices in order to further improve the quality and effectiveness of education. Yağcı and Şentürk (2023) emphasised that educators can provide students with more engaging and interactive learning experiences and encourage collaboration among students by using technology tools. While the boundary between the virtual world and the real world is being blurred by technology, it offers exciting possibilities for the education of the future.

The virtual world in education is an engaging and stimulating space where students can meet online for regular classroom activities, including lessons, discussions, case studies, projects, assignments, tests, and labs. The classes are a mixture of synchronous and asynchronous activities. A virtual world classroom differs from a traditional classroom management system due to its threedimensional (3D) graphical environment, the use of avatars to represent class participants, and the sense of presence that places the student in the scene. The use of virtual worlds enhances learning experiences by extending campusbased and online classrooms. Classrooms in virtual worlds provide opportunities for visualisation, simulation, enhanced social networks and shared learning experiences. in the educational environment, virtual worlds have opened up new possibilities for innovation in the teaching-learning process, whereby the flexibility of accessing information inside or outside the classroom through an avatar has led to a paradigm shift in traditional education in terms of the way information is obtained and transferred with technological tools. The metaverse design includes a variety of course material tools, thus encouraging self-learning and collaborative learning. Effective teaching in the virtual environment has always been the focus of research (Ayiter, 2008; Suh & Ahn, 2022). Due to the COVID-19 pandemic, the school life of many children, espe-

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cially vulnerable children, was disrupted. The emergence of the pandemic limited the movement of people in physical spaces and significantly accelerated the growth of digital content. With the development of various digital technologies such as computing power and networks, the use of immersive virtual environments in the field of education has gradually become a reality. By means of cloud computing and other technologies, teachers and experts are brought together with students in the same virtual learning space (Díaz et al., 2020; Hirsh-Pasek et al., 2022; Mystakidis, 2022). Real interactions between students and teachers are combined with digital twins in the form of avatars or devices to visualise virtual teaching. While physical distance restrictions are removed, teaching efficiency is also greatly increased.

Development of Web Technologies

With the development of internet technology, the Web 1.0 stage was completed, which included understanding of the technologies for creating websites and promoting their content. in the next stage, Web 2.0, in which active, interactive and multilateral communication developed alongside and instead of one-way consumer information, information users increasingly became information producers. Web 3.0, on the other hand, includes the ability to understand, interpret, and categorise the content it collects, and to create and share better content in the same way as humans, thanks to artificial intelligence (AI) and machine learning. in addition, the blogosphere, which includes all blogs and their interconnections, has emerged. The main feature of the blogosphere is websites or other internet tools that enable users to interact with each other by exchanging different types of information. This concept implies that blogs exist as a connected community (or a set of connected communities) or as a social network where each author can freely express their own opinion. The phenomenon of the blogosphere is shaped in the field of internet blogs in which new communications are made. Social media, which is a similar category to the blogosphere phenomenon, overlaps with it technologically. Creating social media involves organising online communities that increase existing public participation and attract additional users. Furthermore, when discussing the types of social media, many researchers include both the main network structures (forums, chat rooms) and the blogosphere that uses and encompasses them. We encounter a unified web space, where each new stage of communication system capabilities, from Web 1.0 to Web 2.0, to Web 3.0, etc., accumulates the capabilities of the previous one in a logical chain. The same is the case with social media; what we call the social media of 2010 is an enhanced version of the "normal" website, forum and blog.

The impact of Web 3.0, also known as the Semantic Web, on online learning has not yet been clearly revealed, as the Semantic Web and its technologies continue to evolve. Online instructors should have a basic understanding of

Web 3.0 in order to prepare for the next stage of online learning. The basis of the Semantic Web is data integration. By using metadata, "display-only" data is transformed into meaningful information that can be located, evaluated, and communicated by software agents. Web 3.0 technologies will aid online instructors in the areas of course development, student support, assessment and record keeping.

Privacy and Security in The Virtual World

Humans quickly adapt to virtual personalities on social media sites such as Facebook, Instagram and Pinterest. Companies and organisations have also been quick to utilise social media in order to further their goals. The use of existing emerging technologies such as gaming, blogging, podcasting, virtual meetings, virtual worlds and Web 3.0 has been accompanied by security and privacy concerns. Virtual identity theft, cyber privacy violations, cyber bullying, cyber fraud, and cyberstalking are becoming widespread and damaging. Privacy and security concerns negatively affect a wide variety of activities, including the virtual world, social media, e-commerce, business communication, marketing, health and education. Considering the virtual world and social media, the importance of the security trio of confidentiality, integrity and availability has been determined (Gogolin et al., 2014). Wang et al. (2022) discussed typical security threats in the metaverse by classifying them in seven dimensions. These dimensions are seen in the taxonomy specified for security threats in the metaverse in Figure 1.



Figure 1. Taxonomy of security threats in the metaverse (Wang et al., 2022)

Decentralised networks prevent a single authority, such as a metaverse service provider, from controlling all aspects of user data. Blockchain technology provides secure data storage by storing data in blocks and associating each block with its predecessor by using a consensus model (Choi et al., 2022). Each block retains the hash value of the previous block, thereby preventing attempts at data manipulation. The metaverse relies on decentralised architecture to avoid the single-point-of-failure security vulnerabilities that are common in centralised databases. Moreover, the secure and indisputable features of the decentralised architecture provide a record of every item of data shared with other entities that use smart contracts. Data requests made using smart contracts are recorded and stored in blocks, thereby providing irrefutable proof that data ownership has been transferred.

Many of the security risks that threaten Metaverse users are similar to those of internet users, such as data hacking, malware attacks, privacy issues and spam (Pooyandeh vd., 2022). to mitigate these risks, metaverse platforms need to implement robust security measures such as two-factor authentication and encryption (Yağcı & Şentürk, 2023). Additionally, metaverse platforms need to be transparent about their data collection practices protecting students' privacy and give users the ability to control how their data is used. Cui et al. (2023), proposed a metaverse education system that leverages VR and "Web 3.0 blockchain technologies" to create a social learning environment that ensures the security, transparency, and fairness of the learning process through an integrated framework. Tran et al. (2022), proposed a "Finger Vein Recognition" approach through metaverse virtual reality and human-robot to prevent cyber bullies from endangering users' avatars, digital assets and private information. in addition, the behavior of users, the words and concepts they use are monitored through artificial intelligence with the latest systems developed. When cyberbullying or ethical violations are detected, teachers or administrators receive the necessary warnings. Studies and research on bullying, theft, violence and ethical violations in the virtual world continue, and new and effective security measures are being developed for these issues.

Chow et al (2022) describe several key technologies required to empower the metaverse, as shown in Figure 2. Immersive technologies are one of the core components of the metaverse. Immersive technologies include visualisation technologies such as extended reality (XR) and head-mounted displays (HMDs) to offer the user a visual representation of virtual content in the metaverse. These technologies connect people to the virtual world and allow them to interact with virtual content by using interaction devices such as hand controllers or hands-free gesture-based methods.



Figure 2. Key technologies required to empower the metaverse (Chow et al., 2022)

In this process, a network is necessary for communication and data transmission over the internet. Advances in 5G technology and beyond provide more efficient and reliable connectivity tools to empower the metaverse. Softwaredefined networking (SDN) is a technology that enables dynamic network management by separating the control plane from the data plane. AI technology will be central to operating the metaverse and automatising various processes. There are a wide variety of AI technologies, including machine learning (ML), deep learning (DL), natural language processing (NLP), computer vision, etc. This technology will be used in the metaverse for various purposes such as creating virtual world content, scene comprehension, object detection, speech-to-text and text-to-speech processing, and human action/activity recognition (Huynh-The et al., 2023).

The Metaverse in Education

In Web 1.0, internet users are only content consumers and content is provided by websites. in Web 2.0 (i.e., the mobile internet), users are both content producers and consumers, and websites are their transformation into serviceproviding platforms. Typical examples of such platforms include Wikipedia, WeChat and TikTok. The metaverse is considered to be the evolving paradigm of Web 3.0. The word "metaverse" is a combination of two terms: "meta-" means going beyond, while "verse" is related to the universe that defines the virtual world connected with the physical world (Ali et al., 2023). Users, represented as digital avatars in the metaverse, can shuttle between various virtual worlds (i.e., sub-metaverses) to experience a digital life, create digital content, and perform medical, educational and economic interactions supported by physical infrastructures and the metaverse engine. The historical development of the metaverse is shown in Figure 3.



Figure 3. Timeline of the metaverse (Sun et al., 2022)

The concept of the metaverse has become a salient concept in a short space of time. Several different definitions of the metaverse can be found in the literature. The general definition of the metaverse as a collective virtual space shared by many users does not explicitly require the metaverse to adopt visualisation technologies (Park & Kim, 2022). However, many people consider visualisation to be an important component of the metaverse (Huynh-The et al.; 2023; Kaplan & Haenlein, 2009). When examined from an etymological point of view, it can be seen that the concept of "metaverse" is derived from the combination of the Greek prefix "meta-", meaning "after, beyond" and "verse", referring to "universe" (Yıldız, 2023). The meaning of the concept in Turkish is "beyond the universe/transcendent" (Demir & Tokgöz, 2022). in fact, companies like Meta regard virtual reality as the foundation for building the metaverse and are investing heavily in the development of this technology (Cheng et al., 2022). The metaverse virtual world consists of 3D spaces where individuals can trade, receive education, conduct studies in the field of medicine, and create social networks (Çetinkaya & Atsan, 2022). As an evolving paradigm of the next-generation internet, the metaverse aims to create a fully immersive, hyperspace-hypertemporal and self-sustaining virtual shared space for people to play, work and socialise. Based on the latest developments in emerging technologies such as XR, AI and blockchain, the metaverse takes a step from science fiction towards an approaching reality. Figure 4 shows six enabling technologies underlying the metaverse.



Figure 4. Illustration of six core technologies and key components of the metaverse (Wang et al., 2022)

The metaverse is a combination of technologies that facilitate the digital interaction of the physical world with virtual environments through virtual reality (VR), augmented reality (AR), mixed reality (MR), extended reality (XR), and brain-computer interfaces (BCIs). Moreover, the metaverse is considered as a network of a virtual world where the interaction of avatars provides an immersive experience in the virtual world. in the metaverse, an immersive experience is achieved through AI, blockchain, robotics, computer vision, the internet of things (IoT), cloud/edge computing, AR, etc., a powerful economic system based on blockchain technology can be set up, and highly accurate and precise forecasting systems are being developed based on AI technology. The application areas of the metaverse are summarised in Figure 5.



Figure 5. Application areas of the metaverse

Metaverse application has the potential to enable new development for different sectors such as education, healthcare, medicine, the tourism industry, ecommerce, agriculture, social networking, smart cities, and entertainment or gaming. Based on the restructuring of the traditional classroom in education, metaverse application can achieve many things that are difficult or impossible to achieve under real-life conditions. For example, in the metaverse, students can perform experiments on their own involving hazardous chemical reactions, which helps improve laboratory safety (Kanematsu et al., 2014). Science experiments often require a large number of conditions and materials that are difficult to obtain, but students also need to repeat the experiments many times in order to gain proficiency. A virtual experimental environment can meet a high standard of teaching requirements while also reducing education costs

(Almarzouqi et al., 2022; Locurcio, 2022). However, virtual environments related to education should be designed in line with the findings and teaching principles of educational science. Moreover, too much interaction may cause distraction in students (Hirsh-Pasek et al., 2022).

Virtual Reality (VR) in Education and Example Applications

The aim of VR technology is to create "immersive, interactive and creative" simulations for the user through visual, tactile and auditory outputs (De Paolis & Mongelli, 2015). It is a volumetric graphical world in which the user can look around and move around. The aim of VR is to provide a fully immersive experience that completely removes the user from reality and transports them into a virtual world. The popularity of VR technology on gaming platforms is well established today, but it is also attracting attention in the field of education. VR is being used more and more in education, enabling students to explore and to create their own knowledge. As well as increasing the speed of learning, VR supports student and teacher motivation and engagement in general. The use of VR ensures a student-centred approach in which students actively participate in the learning process (Soliman et al., 2021). Lin and Sumerdani (2022) revealed that science teaching with VR is suitable for integration with the 5E learning model in order to visualise abstract concepts. Therefore, VR provides a real opportunity for students to be curious and to participate in the inquiry process. Smith et al. (2023), meanwhile, developed a smartphone-based VR plotting system for science, technology, engineering and mathematics (STEM) education. With regard to this, example visualisations for various STEM disciplines are included in Figure 6.



(a) A hyperbolic paraboloid can be (b) A parametric curve is used to (c) The crystal structure of NaCl. studied in a multivariate mathematics course.





draw a helix.



VR provides students with permanent learning and experiences in which educational practices, professional practices, and experiences in the stages of learning are combined with visuals. An environment that we cannot see or create in real life can be created in VR. It is a proven fact that visual elements in the virtual world will also make great contributions to people's learning abilities. in addition to these, VR plays an important role in special education. in a study conducted in the UK, children with communication and mobility difficulties were enabled to live their lives, which they could not do under normal conditions due to their disabilities, by using VR environments (Helsel, 1992). Again, at the Oregon Research Institute, children using wheelchairs were given education through VR environments on potentially dangerous situations that they could encounter in daily life (Isdale, 1993).

Augmented Reality (AR) in Education and Example Applications

AR, which bridges the gap between the virtual and real worlds, creates an enhanced and augmented reality. Especially with a new technology such as AR, a breath of fresh air can be given to the teaching of challenging subjects in science teaching. in this way, the student is not a passive participant in the process, but becomes an individual who actively constructs knowledge. This change is due to the use of various applications developed recently in educational environments. Thanks to AR applications, students have the opportunity not only to hear and see, but also to interact with virtual environments in the real world (Kerawalla et al., 2006). AR is a very suitable technology for educational institutions. Students can improve their knowledge and skills, especially about complex theories or systems. in their study, Liarokapis et al. (2004) showed that difficult theories and complex mechanisms in higher education can be learned by students with contextually enriched interaction using AR technology. Again, Rambli et al. (2013) carried out the design of an AR alphabet book to teach the alphabet to preschool children. It was concluded that the unique interface that brings together real and virtual objects functions as a natural attention-grabbing and entertaining learning tool for this age group.

The coexistence of virtual objects and real environments enables students to visualise complex spatial relationships and abstract concepts (Arvanitis et al., 2007), to experience phenomena that are not possible in the real world (Klopfer & Squire, 2008), and to develop their literacy with two-dimensional (2D) and 3D synthetic objects (Kerawalla et al., 2006) that they cannot develop or implement in other technology-supported learning environments (Squire & Jan, 2007). in their study, Kaufmann and Schmalstieg (2003) developed the "Construct3D" application, which is a 3D tool specially designed for mathematics and geometry education. The application is based on the mobile collaborative AR system "Studierstube". At the end of the study, it was concluded that Construct3D is easy to learn, encourages experimentation with geometric structures, and develops spatial skills. Figure 7 shows visuals related to this application.



(a) shows a simple insertion of a sphere into a cone



(b) shows a simple example from vector algebra Figure 7. Examples of students' work with Construct3D (Kaufmann & Schmalstieg, 2003)

Chiu et al. (2015) concluded in their study that combining real and virtual experiences in augmented virtual science laboratories helps students build knowledge on intuitive ideas and develop molecular-level explanations of macroscopic phenomena. in the study, the "Frame", a sensor-augmented virtual laboratory that uses sensors as physical inputs, was used to control scientific simulations. It was seen that students using the "Frame" lab made progress in developing molecular-level explanations of gas behaviour and transforming alternative and partial ideas about gases into normative ideas.

Mixed Reality (MR) in Education and Example Applications

MR is a mixed or hybrid reality. in MR, the user can interact with both digital and physical elements. MR differs from AR, where digital and physical elements do not interact, and VR, where the physical or real world is completely blocked. MR intersects imperceptibly with the real world. The reality-virtuality continuum introduced by Milgram and Kishino (1994) is shown below. At one end of this continuum is the real world, while at the other end is the virtual environment. As shown in Figure 8, the "virtuality continuum" concept relates to the mixture of object classes presented in any particular display situation, where real environments are shown at one end of the continuum and virtual environments are shown at the other end. On the reality-virtuality continuum, MR is defined as an environment that blends real and virtual content. AR is an environment in which the real environment is enriched with virtual content, that is, where virtual content is superimposed on the real world. On the other hand, VR is an environment where the user is completely immersed in virtual computer-generated content and has a limited perception of the real environment. Therefore, VR is located on the right-hand side of the reality-virtuality continuum.



Figure 8. The reality-virtuality continuum introduced by Milgram and Kishino (Milgram & Kishino, 1994)

As indicated in Figure 8, the simplest way to view an MR environment is an environment in which real-world and virtual-world objects are presented together on a single screen, that is, anywhere between the extremes of the virtuality continuum (Milgram and Kishino, 1994). While AR enables a virtual/digital element to be placed in a real environment, MR allows the whole body to be integrated with real and virtual elements along the reality continuum (Maas & Hughes, 2020). in MR environments, virtual/digital overlays or objects are not only visible to the user, but can also be physically interacted with. It is this ability to interact with digital/virtual overlays in the real environment that distinguishes AR from MR. in their study on the effectiveness of learning design with MR in higher education, Tang et al. (2019) stated that students' geometric analysis and creativity skills improved significantly after working with the support of MR technology. Figure 9 shows that digital content can be displayed in front of the user once the teaching material has been recognised.



(a) Hardware and configuration of HoloLens



(b) Basic movements of HoloLens used in the

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(c) Aircraft turbofan engine and command manual

developed application



Figure 9. Images of effectiveness of learning design with MR in higher education (Tang et al., 2019)

In their study, de Souza e Silva and Delacruz (2006) created a learning environment with MR about the history of Amsterdam through the "Frequency 1550" hybrid reality game, while Birchfield and Megowan-Romanowicz (2009) applied the Situated Multimedia Arts Learning Laboratory (SMALLab) technology in science education in their study. in recent years, studies on the use of MR in education have increased.

Extended Reality (XR) in Education and Example Applications

XR is a medium that creates environments that combine real and virtual elements or presents a completely virtual environment for people to experience (Rantakokko, 2022). in terms of visualisation, many people often associate XR with the metaverse. XR is in fact an umbrella term covering AR, VR, MR and other immersive technologies (Chow et al., 2022). XR describes the display of computer-generated images in the user's field of view and spans a broad spectrum from real life (no digital augmentation) to VR (Figure 10).



HMDs (head-mounted displays) are used to include the XR user in the metaverse. The HMD is a display device worn by the user in which images representing virtual content are projected onto the user's visual system via the HMD's built-in screens. HMDs are generally equipped or combined with a tracking mechanism to monitor the user's head movement to update images in real time based on where the user is looking. If images are not updated and displayed to the user quickly enough, this can cause cybersickness, in which various negative physical effects can be seen such as eyestrain, headaches, disorientation and nausea (Rebenitsch & Owen, 2016).

XR enables students to increase teacher-student interaction and connectivity and to control their learning strategies more actively (Kuleto et al., 2021). The application of XR technology in education is characterised in four ways. These are (1) observational learning, (2) operational learning, (3) social learning, and (4) academic research (Liu et al., 2017). Application scenarios of XR in education are specified as (1) smart education product design, (2) implementation of game-based learning, (3) creating an intelligent learning environment, (4) design education, and (5) special education (Chu et al., 2019). Some studies conducted in fields such as science education (Shim et al., 2003), language education (Panagiotidis, 2021), music education (Matthias et al., 2019), health education (Aebersold, 2020) and art education (Gao, 2021) have investigated the effectiveness of this technology by revealing its areas of use.

In their study, Chytas et al (2020) provide an overview of the application of AR technology in anatomy education and recommend that educators use XR

technology in addition to using AR to reveal the details of human anatomy and surgical procedures in a VR environment. in these studies, 3D holograms naturally help to improve intuitive understanding and spatial awareness through stereoscopic vision (Ghaednia et al., 2021). in the context of spinal surgery education and training, the use of XR technology, including 3D holograms and intraoperative visualisation for preoperative planning, can make learning effective in surgical and anatomical education and enable the faster acquisition of the relevant skills. in this way, it can contribute to correct and safe surgical practices (Ghaednia et al., 2021; Lohre et al., 2020; Pfandler et al., 2017; Yoo et al., 2019).

In their study, Baumgartner et al. (2022) investigated the effect of XR on spatial reasoning in primary school students. They revealed that XR led to improvement in overall spatial reasoning ability in primary school students receiving science education. in their study, Cárdenas-Sainz et al. (2022) presented the design of an interactive learning tool named "FisicARtivo", which focuses on teaching physics with real-time simulations in XR. They showed that the use of XR technologies had a significant impact on physics learning. in a study by Kotcherlakota et al. (2023), the University of Nebraska Medical Center (UNMC) aimed to increase human performance and effectiveness in healthcare through the adoption of interprofessional collaboration and experiential learning technologies with an XR educational innovation programme called the Interprofessional Experiential Center for Enduring Learning (iEX-CEL). in the study, a user wearing stereoscopic glasses has the experience of performing his/her duty by disinfecting the virtual hospital room (Figure 11a). The type of hand controls used in each technology includes medical illustration, simulation, and computer programming experience using a game development platform such as "Unity" to create learning activities that have real impacts on the healthcare environment, as shown in Figure 11b.



(a) Student disinfecting the virtual hospital room



(b) The learner in the virtual hospital room interacts with the audience to draw attention to a teaching point

Figure 11. XR educational innovation programme called the Interprofessional Experiential Center for Enduring Learning (iEXCEL), (Kotcherlakota et al., 2023)

The Brain-Computer Interface (BCI) in Education

BCIs are communication devices that enable users to send commands to a computing device using only brain activity (Wolpaw et al., 2002). BCIs translate brain activity into commands in order to control surrounding technology. A range of sensors detects brain activities and converts these into electrical signals that are processed by machine learning algorithms. When the desired type of brain response, such as imagined speech or emotional state, is detected, the computer generates the corresponding control command. Some of the BCI application areas includes independent mobility (such as using a wheelchair), communication (such as assistive communication devices) and even participation in the therapeutic arts. BCIs offer endless possibilities for intuitive, hands-free interaction with the world. BCIs are categorized according to the electroencephalographic (EEG) recording method. There are three different types of BCI that are currently available: invasive, partially invasive, and non-invasive (Vourvopoulos & Liarokapis, 2014).

In their study, Katona and Kovari (2016) offered recommendations for the development, implementation and testing of an EEG-based engineering education project, concluding that engineering students applied the theory they learned with the BCI and developed their knowledge and skills in the field of observation and evaluation of electrical signals produced by brain activity and measured by biosensors. The main goal of the project was to develop and test a BCI interface that can measure the average attention level. Verkijika and De Wet (2015) used a BCI to reduce mathematics anxiety in their study. Analysis of the data collected in two training sessions with the BCI mathematics educational game showed that mathematics anxiety can be effectively trained and reduced with a BCI application. The BCI application is shown in Figure 12.



(a) Screenshot of the Math-Mind game



(b) Screenshot of the Math-Mind game with realtime feedback showing a high level of mathematics anxiety in the game player

Figure 12. Using a BCI to reduce mathematics anxiety (Math-Mind game) (Verkijika & De Wet, 2015)

In their study, Cai et al. (2022) aimed to investigate the effect of an AR scientific inquiry tool based on a BCI on primary school students' scientific performance, flow experience, self-efficacy, and cognitive load. in the study, the subject of the lever principle was selected from the sixth grade science textbook. An image of the application is shown in Figure 13. The results of the study showed that the BCI-based AR helped improve students' scientific inquiry performance and encouraged students' participation in scientific inquiry. Moreover, the students had a good experience in developing their self-efficacy.



Figure 13. Attention feedback in the BCI-based AR inquiry tool (Cai et al., 2022)

Second Life in Education

Second Life (SL), which is popular among virtual worlds, was launched in 2003 by Linden Lab. SL is an online service that aims to create 3D social virtual worlds for people to establish simultaneous relationships between themselves in order to share their interests or activities (Memikoğlu, 2014). in this virtual application, in which users can interact verbally and non-verbally, interaction is carried out through avatars (Barnes & Pressey, 2011). SL is used effectively especially by non-profit organisations. It is used by many colleges, schools, libraries, and universities as an educational platform. Many national and international universities use the SL platform as a virtual campus in order to strengthen their education programmes. in Türkiye, Çağ University, Bilkent University, METU, Bahçeşehir University, and among universities in other countries, Harvard University, the University of Texas, the University of South Florida, Arkansas State University, the University of Western Australia (Figure 14), Stanford University, and the University of Oregon have created virtual campuses on the SL platform. SL continues its existence as an online living space, and activities are carried out by important universities by using SL as an education and training area together with virtual classroom and campus applications.

Dadakoğlu and Aksoy (2020) stated that in education, SL provides a very rich environment for constructivist learning, socialisation, and research and discovery, and that students acquire the skills and strategies to use technological tools and create 3D designs. Warburton (2009) stated that SL is the most mature virtual world application used in the field of education, and also that virtual worlds are attractive spaces for education.



Figure 14. The University of Western Australia in SL

Schiller (2009), in her pedagogical design and evaluation study of an SL project to implement student-centred teaching, showed that students who were guided by the principles of student-centred teaching methodology were able to apply what they learned in the classroom into a virtual environment through exploration and interaction. in their study, in which they sought the opinions of preservice teachers, Ertürk and Şahin (2019) found that by using experiential learning, social studies education organised in a SL virtual environment increased interest and motivation towards the course, enabled concrete and permanent learning, rescued the course from the routine, increased selfefficacy levels, and allowed for instant feedback.

Hassan et al. (2016) stated that SL for language education has the potential to improve English language proficiency and should be explored as a new alternative in English learning. Kazazoğlu (2014) emphasised that the use of SL will bring a new perspective to foreign language teaching, can be included in education systems, can be used as foreign language material, and can be evaluated within the framework of blended teaching. İliç and Arıkan (2016) stated in their study that SL can be used in many different fields besides foreign language teaching. Wiecha et al. (2010) emphasised that SL provides a space for constructivist learning for medical education and offers a tremendous oppor-

tunity to improve learning outcomes beyond the traditionally designed continuing medical education courses.

Conclusion

Virtual reality programs are shown as one of the effective experiment tools in science education (Bayraktar & Kaleli, 2007). in the created virtual laboratories, students can conduct three-dimensional and interactive experiments. It is useful to utilize virtual reality in science education where experimental studies are carried out intensively. Expensive and dangerous experiments can be implemented easily, safely and cost-effectively in virtual laboratories. in this way, it becomes easier to obtain many experiences such as gaining skills, gaining experience, developing motor skills, and raising awareness regarding the subject being studied. Thanks to these environments, students can make mistakes and work comfortably without fear of making mistakes even in dangerous subjects. The mistakes made are notified to the students with the instant feedback of the system and the mistakes are corrected instantly (Alebous, 2021; Chan, et al., 2021).

With virtual reality applications, individuals who are far away from each other and have a common interest can come together for joint projects and have different experiences. Individuals who come together in virtual reality software can distribute tasks and work together simultaneously or asynchronously. Collaborative studies and project studies can be carried out with tools such as meeting rooms, project cycle module and evaluation module in virtual environments. Most studies have a positive view of using virtual reality technology in education. It has been determined that the trainings realized with Virtual Reality technologies are interesting and provide permanent learning. These results show that virtual reality should be used more in the field of education (Huang, et al., 2010; Rinn, et al., 2023). At this point, it is important for educators to have knowledge and skills about virtual reality applications. Teachers who do not have enough experience in virtual reality should be trained on this subject. in addition, pre-service teachers should also be trained in this direction (Battal & Taşdelen, 2023; Kahveci & Sondaş, 2023).

In the virtual environment, students can socialise more quickly thanks to collaboration born out of necessity. This in turn can facilitate one-on-one interaction and improve decision-making ability. Students who study in the virtual environment can improve their skills and develop their own potential even without realising it. in order to develop these qualities, students need constant encouragement from the people around them, their family or their teachers. in a singular environment or with classroom participation, VR enables students to perform activities aimed at learning by playing and exploring their own minds, apart from just playing games. Kalyuga (2007) states that virtual worlds are highly interactive in that they provide dynamic feedback, learner experimentation, real-time personalised task selection, and exploration. It is also emphasised that virtual worlds have other educational benefits such as enabling creativity in a rich media environment, providing opportunities for social interaction and community building, facilitating collaboration, increasing a sense of shared presence, dissolving social boundaries, reducing social anxiety, increasing student motivation and participation, and adapting to the learning preferences of generations Y and Z (Amichai-Hamburger & McKenna, 2006; Barab et al., 2005; Craig, 2007; Dede et al., 2005). VR/AR/MR applications should adopt a student-centred, inspiring instructional design with an emphasis on collaborative interaction and on activities that combine formal and non-formal learning. Through virtual worlds, students are familiarised with meaningful, real-life situations and can anticipate the problems they may encounter in business life and be prepared accordingly. Virtual worlds offer new learning opportunities and practical benefits for students. The importance of linking the use of digital technologies in education to a specific instructional goal and objective has been widely reported (Makransky & Petersen, 2021; Mulders et al., 2020; Radianti et al., 2020). VR and AR applications increase interaction between students and teachers, provide time- and placeindependent teaching opportunities, allow very difficult or potentially dangerous experiments to be carried out in virtual laboratory environments, provide students with new and different experiences, and enable learning with fun (İzgi Onbaşılı, 2018; Wu et al., 2013). Therefore, these applications can be integrated into educational environments. It is also important to provide educational content with a multi-sensory experience for educational purposes without distracting attention (Straub, 2009). It is clear that innovative instructional design is one of the key factors required for successful implementation in education. While research on virtual world software continues, research on the pedagogical use of these technologies has increased in recent years. in this context, it is very important for innovative teachers to follow the studies, research and applications related to the virtual world and to adapt the results to the education process.

References

- Aebersold, M. (2020). Facilitator guide to using the xr unnovation for healthcare videos: Caring for patients who are deaf or hard of hearing. University of Michigan: Ann Arbor, MI, USA. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/163521/Facilitator%20Guide%20t o%20Using%20the%20Videos.pdf?sequence=3&isAllowed=y
- Alebous, T. M. (2021). The extent to which teachers of science subjects use virtual scientific laboratories during corona virus pandemic: the reality & hope. *Journal for the Education of Gifted Young Scientists*, 9(3), 193-206. http://dx.doi.org/10.17478/jegys.972540
- Ali, S., Abdullah, Armand, T.P.T., Athar, A., Hussain, A., Ali, M., Yaseen, M., Joo, M.-I., & Kim, H.-C. (2023). Metaverse in healthcare integrated with explainable AI and blockchain: Enabling immersiveness, ensuring trust, and providing patient data security. *Sensors*. 23(2), 565. https://doi.org/10.3390/s23020565
- Almarzouqi, A., Aburayya, A., & Salloum, S. A. (2022). Prediction of user's intention to use metaverse system in medical education: A hybrid SEM-ML learning approach. IEEE Access, 10, 43421-43434. https://doi.org/10.1109/ACCESS.2022.3169285
- Amichai Hamburger, Y., & McKenna, K. (2006). The contact hypothesis reconsidered: Interacting via the Internet. Journal of Computer-Mediated Communication, 11(3), 825–843.
- Arvanitis, T. N., Petrou, A., Knight, J. F., Savas, S., Sotiriou, S., Gargalakos, M., & Gialouri, E. (2007). Human factors and qualitative pedagogical evaluation of a mobile augmented reality system for science education used by learners with physical disabilities. *Personal and Ubiquitous Computing*, 13(3), 243-250. http://dx.doi.org/10.1007/s00779-007-0187-7
- Ayiter, E. (2008). Integrative art education in a metaverse: ground. *Technoetic Arts a Journal of Speculative Research*, 6(1), 41–53, https://doi.org/10.1386/tear.6.1.41_1
- Bailenson, J. (2018). Experience on demand: What virtual reality is, how it works, and what it can do. WW Norton & Company.
- Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzan, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology Research and Development*, 53(1), 86-107.
- Battal, A., & Taşdelen, A. (2023). The use of virtual worlds in the field of education: A bibliometric study. Participatory Educational Research (PER), 10(1), 408-423.
- Huang H., Rauch U., & Liaw S., (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. Computers & Education, 55(3), 1171-1182.
- Huynh-The, T., Pham, Q. V., Pham, X. Q., Nguyen, T. T., Han, Z., & Kim, D. S. (2023). Artificial intelligence for the metaverse: A survey. *Engineering Applications of Artificial Intelligence*, 117, 105581. https://doi.org/10.1016/j.engappai.2022.105581
- Barnes, S. J., & Pressey, A. D. (2011). Who needs cyberspace? Examining drivers of needs in Second Life. Internet Research, 21 (3), 236-254. https://doi.org/10.1108/10662241111139291
- Baumgartner, E., Ferdig, R.E. & Gandolfi, E. (2022). Exploring the Impact of Extended Reality (XR) on Spatial Reasoning of Elementary Students. *TechTrends*, 66, 825–836. https://doi.org/10.1007/s11528-022-00753-6
- Birchfield, D., & Megowan-Romanowicz, C. (2009). Earth science learning in SMALLab: A design experiment for mixed reality. *International Journal of Computer-Supported Collaborative Learning*, 4, 403-421. https://doi.org/10.1007/s11412-009-9074-8
- Cai, S., Liu, Z., Liu, C.H., Zhou, H., & Li, J. (2022). Effects of a BCI-Based AR Inquiring Tool on Primary Students' Science Learning: A Quasi-Experimental Field Study. J. Sci Educ Technol, 31, 767-782. https://doi.org/10.1007/s10956-022-09991-y
- Cárdenas-Sainz, B. A., Zatarain-Cabada, R., Barrón-Estrada, M. L., Chavez-Echeagaray, M. E., & Cabada, R. Z. (2022). FisicARtivo: Design of a learning tool for physics education using web-based XR technology. in 2022 IEEE Mexican International Conference on Computer Science (ENC) (pp. 1-8). IEEE.
- Chan, P., Van Gerven, T., Dubois, J-L., & Bernaerts, K. (2021). Virtual chemical laboratories: A systematic literature review of research, technologies and instructional design. *Computers and Education Open*, 2(2021), 100053. https://doi.org/10.1016/j.caeo.2021.100053
- Cheng, R., Wu, N., Chen, S., & Han, B. (2022). Will Metaverse Be NextG Internet? Vision, Hype, and Reality. *IEEE Network*, 36(5), 197-204. http://doi.org/10.1109/MNET.117.2200055

- Chiu, J. L., DeJaegher, C. J., & Chao, J. (2015). The effects of augmented virtual science laboratories on middle school students' understanding of gas properties. *Computers & Education, 85, 59-73*. https://doi.org/10.1016/j.compedu.2015.02.007
- Chow, Y.W., Susilo, W., Li, Y., Li, N., & Nguyen, C. (2022). Visualization and cybersecurity in the metaverse: A survey. J. Imaging, 9(1), 11. http://doi.org/10.3390/jimaging9010011
- Chu, L., Chen, W., Yue, T., & Zheng, S. (2019). Rebuilding the experience: Extended reality (XR) technology and its education application outlook: Also discuss the trend of "education and new technology integration". J. Distance Educ, 37, 17-31.
- Chytas, D., Johnson, E. O., Piagkou, M., Mazarakis, A., Babis, G. C., Chronopoulos, E., Nikolaou, V. S., Lazaridis, N., & Natsis, K. (2020). The role of augmented reality in Anatomical education: An overview. Annals of Anatomy-Anatomischer Anzeiger, 229, 151463. https://doi.org/10.1016/j.aanat.2020.151463
- Craig, E. (2007). Meta-perspectives on the metaverse: A blogsphere debate on the significance of Second Life. Paper contributed to the ED-MEDIA World Conference on Educational Multimedia, Hypermedia and Telecommunications, Vancouver, Canada.
- Cui, L. B., Zhu, C. Z., Hare, R., & Ying, T. (2023). MetaEdu: A new framework for future education. Discover Artificial Intelligence, 3: 10. https://doi.org/10.1007/s44163-023-00053-9
- Çetinkaya, S. & Atsan, M. (2022). Pazarlamanın blok zincir deneyimi blockchain (Editör Karsu, S.). Dijital kimlik: Metaverse içinde (ss. 109-130). Nobel Akademik Yayıncılık.
- Dadakoğlu, S. C., & Aksoy, Ş. (2020). Features of Second Life virtual environment and evaluation within the scope of art education: Second Life sanal ortamının özellikleri ve sanat eğitimi kapsamında değerlendirilmesi. *Journal of Human Sciences*, 17(2), 485-512. https://doi.org/10.14687/jhs.v17i2.5769
- De Paolis, L., & Mongelli, A. (2015). Augmented and virtual reality. in Second International Conference, AVR 2015, Lecce, Italy, August 31-September 3, 2015, Proceedings. Lecture Notes in Computer Science (Vol. 9254).
- de Souza e Silva, A., & Delacruz, G. C. (2006). Hybrid reality games reframed: Potential uses in educational contexts. Games and Culture, 1(3), 231-251. https://doi.org/10.1177/1555412006290443
- Dede, C. J., Clarke, D., Ketelhut, B., Nelson, B., & Bowman, C., (2005). Fostering motivation, learning, and transfer in multi-user virtual environments. Paper contributed to the American educational research association conference, Montreal, Canada.
- Demir, M. & Tokgöz, E. (2022). Snow Crasht'ten Meta'ya, Metaverse'in Kavramsal Ve Teknolojik Gelişimi. N. Göker ve G. Göker (Ed.), İletişim ve medya alanında uluslararası araştırmalar-IV içinde (s. 69-92). Eğitim Yayınevi.
- Díaz, J., Saldaña, C. & Ávila, C. (2020). Virtual world as a resource for hybrid education. International Journal of Emerging Technologies in Learning (iJET), 15(15), 94-109.
- Ertürk, M. & Şahin, G. (2019). The Use of Second Life Game as an experimental learning model for learning social studies. *Hacettepe University Journal of Education*, 34(2), 434-459.
- Gao, M. (2021). XR-TECAN teaching model for Chinese traditional art education. *Science Insights Education Frontiers*, 10(1), 1365-1380.
- Ghaednia, H., Fourman, M. S., Lans, A., Detels, K., Dijkstra, H., Lloyd, S., Sweeney, A., Oosterhoff, J. H. F., & Schwab, J. H. (2021). Augmented and virtual reality in spine surgery, current applications and future potentials. *The Spine Journal*, 21(10), 1617-1625. https://doi.org/10.1016/j.spinee.2021.03.018
- Gogolin, G., Gogolin, E., & Kam, H. (2014). Virtual worlds and social media: Security and privacy concerns, implications, and practices. *International Journal of Artificial Life Research (IJALR)*, 4(1), 30-42. http://doi.org/10.4018/ijalr.2014010103
- Hassan, R. F., Dzakiria, H. & Idrus, R. M. (2016). Using Second Life Platform for improving English language skills: Students' perception. International Review of Management and Marketing, 6(8), 43-47.
- Helsel, S. (1992). Virtual reality and education. Educational Technology, 32(5), 38-42.
- Hirsh-Pasek, K., Zosh, J. M., Hadani, H. S., Golinkoff, R. M., Clark, K., Donohue, C., & Wartella, E. (2022). A whole new world: Education meets the metaverse. Policy Brief, Center for Universal Education at The Brookings Institution, 1-13. https://files.eric.ed.gov/fulltext/ED622316.pdf

- Huynh-The T., Pham Q.V., Pham X.Q., Nguyen T.T., Han Z., & Kim D.S. (2023). Artificial intelligence for the metaverse: A survey. *Engineering Applications of Artificial Intelligence*, 117, 105581. http://doi.org/10.1016/j.engappai.2022.105581
- Isdale, J. (1993). What is virtual reality? Available online: http://www.columbia.edu/~rk35/vr/vr.html (accessed on 27 June 2023).
- İliç, U. & Arıkan, Y. D. (2016). Analysis of student views on foreign language learning in second life environment. Turkish Online Journal of Qualitative Inquiry, 7(4), 364-395. https://doi.org/10.17569/tojqi.84832
- İzgi-Onbaşılı, Ü. (2018). The effect of augmented reality practices on the attitudes of primary school students towards augmented reality practices and science motivation. *Ege Journal of Education*, 19(1), 320-337. https://doi.org/10.12984/egeefd.390018
- Kahveci, A. H. F., & Sondaş, A. (2023). Eğitimde sanal gerçeklik teknolojisine genel bakış. Kocaeli Üniversitesi Fen Bilimleri Dergisi, 6(1), 6-13. https://doi.org/10.53410/koufbd.1134394
- Kalyuga, S. (2007). Enhancing instructional efficiency of interactive e-learning environments: A cognitive load perspective. *Educational Psychology Review*, 19(3), 387–399.
- Kanematsu, H., Kobayashi, T., Barry, D. M., Fukumura, Y., Dharmawansa, A., & Ogawa, N. (2014). Virtual STEM class for nuclear safety education in metaverse. *Procedia Computer Science*, 35, 1255–1261. https://doi.org/10.1016/j.procs.2014.08.224
- Kaplan, A. M., & Haenlein, M. (2009). The fairyland of Second Life: Virtual social worlds and how to use them. Business Horizons, 52(6), 563-572. http://doi.org/10.1016/j.bushor.2009.07.002
- Katona, J., & Kovari, A. (2016). A brain–computer interface project applied in computer engineering. IEEE Transactions on Education, 59(4), 319-326. https://doi.org/10.1109/TE.2016.2558163
- Kaufmann, H., & Schmalstieg, D. (2003). Mathematics and geometry education with collaborative augmented reality. Computers & Graphics, 27(3), 339-345. https://doi.org/10.1016/s0097-8493(03)00028-1
- Kazazoğlu, S. (2014). Technology-based interaction in foreign language teaching: The case of second life. Dil Dergisi, 164, 39-51. https://doi.org/10.1501/Dilder_000000210
- Kerawalla, L., Luckin, R., Seljeflot, S., & Woolard, A. (2006). "Making it real": Exploring the potential of augmented reality for teaching primary school science. *Virtual Reality*, 10(3), 163–174.
- Klopfer, E., & Squire, K. (2008). Environmental detectives: The development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development*, 56(2), 203–228. http://dx.doi.org/10.1007/s11423-007-9037-6
- Kotcherlakota, S., Beam, E., Ricks, B., Swanson, R., Schuelke, S., Armijo, P. R., Glass, B., Wilt, J., & Sıu, K. C. (2023). Bridging the XR Technology-to-Practice Gap: Methods and Strategies forBlending Extended Realities into Classroom Instruction. in T. Cherner & A. Fegely (eds.), An interprofessional network approach to increase XR use in healthcare. Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/222242/ ISBN: 978-1-939797-67-4. 169-185
- Kuleto, V., Stanescu, M., Ranković, M., Šević, N. P., Păun, D., & Teodorescu, S. (2021). Extended reality in higher education, a responsible innovation approach for generation y and generation z. Sustainability, 13 (21), 11814.
- Liarokapis, F., Mourkoussis, N., White, M., Darcy, J., Sifniotis, M., Petridis, P., Basu, A., & Lister, P. (2004). Web3D and augmented reality to support engineering education. World Transactions on Engineering and Technology Education, 3(1), 11-14.
- Lin, C. H., & Sumardani, D. (2023). Transitioning to virtual reality learning in 5E learning model: pedagogical practices for science learning. *Interactive Learning Environments*, 1-15. https://doi.org/10.1080/10494820.2022.2160468
- Liu, D., Bhagat, K. K., Gao, Y., Chang, T. W., Huang, R. (2017). The potentials and trends of virtual reality in education. in D. Liu, C., Dede, R., Huang, J., Richards (eds), *Virtual, augmented, and mixed realities in education* (pp. 105–130). Springer. https://doi.org/10.1007/978-981-10-5490-7_7
- Locurcio, L. L. (2022). Dental education in the metaverse. British Dental Journal, 232(4), 191. https://doi.org/10.1038/s41415-022-3990-7
- Lohre, R., Wang, J. C., Lewandrowski, K. U., & Goel, D. P. (2020). Virtual reality in spinal endoscopy: a paradigm shift in education to support spine surgeons. *Journal of Spine Surgery*, 6(Suppl 1), 208-223. https://doi.org/10.21037/jss.2019.11.16

- Maas, M. J., & Hughes, J. M. (2020). Virtual, augmented and mixed reality in K–12 education: A review of the literature. *Technology, Pedagogy and Education*, 29(2), 231–249. https://doi.org/10.1080/1475939X.2020.1737210
- Makransky, G., & Petersen, G. B. (2021). The cognitive affective model of immersive learning (CAMIL): A theoretical research-based model of learning in immersive virtual reality. *Educational Psychology Review*, 33 (3), 937-958. https://doi.org/10.1007/s10648-020-09586-2
- Matthias, P., Billinghurst, M., & Siang See, Z. (2019). This land AR: An Australian music and sound XR installation. in The 17th International Conference on Virtual-Reality Continuum and its Applications in Industry (pp. 1-2).
- Memikoğlu, İ. (2014). Utilization of Second Life as a tool for spatial learning in interior architecture. Procedia-Social and Behavioral Sciences, 116, 1288-1292. https://doi.org/10.1016/j.sbspro.2014.

01.384

- Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE Transactions on Information and Systems*, 77(12), 1321-1329.
- Mulders, M., Buchner, J., & Kerres, M. (2020). A framework for the use of immersive virtual reality in learning environments. *International Journal of Emerging Technologies in Learning (iJET)*, 15(24), 208-224. https://doi.org/10.3991/ijet.v15i24.16615

Mystakidis, S. (2022). Metaverse. Encyclopedia, 2(1), 486-497. https://doi.org/10.3390/encyclopedia 2010031

- Panagiotidis, P. (2021). Augmented and mixed reality in language learning. *European Journal of Education*, 4(2), 28-44.
- Park, S. M., & Kim, Y. G. (2022). A metaverse: Taxonomy, components, applications, and open challenges. *IEEE Access*, 10, 4209-4251. http://doi.org/10.1109/ACCESS.2021.3140175
- Pfandler, M., Lazarovici, M., Stefan, P., Wucherer, P., & Weigl, M. (2017). Virtual reality-based simulators for spine surgery: A systematic review. *The Spine Journal*, 17(9), 1352-1363. https://doi.org/10.1016/j.spinee.2017.05.016
- Pooyandeh, M., Han, K. J., & Sohn, I. (2022). Cybersecurity in the AI-Based Metaverse: A survey. Applied Sciences, 12(24), 12993. https://doi.org/10.3390/app122412993
- Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778. https://doi.org/10.1016/j.compedu.2019.103778
- Rambli, D. R. A., Matcha, W., & Sulaiman, S. (2013). Fun learning with AR alphabet book for preschool children. *Procedia computer science*, 25, 211-219. https://doi.org/10.1016/j.procs.2013.11.026
- Rantakokko, S. (2022). Data handling process in extended reality (XR) when delivering technical instructions. *Technical Communication*, 69(2), 75-96. https://doi.org/10.55177/tc734125
- Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online university teaching during and after the Covid-19 crisis: Refocusing teacher presence and learning activity. *Postdigital Science and Education*, 2, 923-945.
- Rebenitsch, L., & Owen, C. (2016). Review on cybersickness in applications and visual displays. *Virtual Reality, 20,* 101-125. http://doi.org/10.1007/s10055-016-0285-9
- Rinn, H., Khosrawi-Rad, B., Grogorick, L., Robra-Bissantz, S., & Markgraf, D. (2023). Virtual worlds in education: A systematic literature review. Thirty-first European Conference on Information Systems (ECIS), Kristiansand, Norway.
- Schiller, S. Z. (2009). Practicing learner-centered teaching: Pedagogical design and assessment of a second life project. *Journal of Information Systems Education*, 20(3), 369-381.
- Shim, K. C., Park, J. S., Kim, H. S., Kim, J. H., Park, Y. C., & Ryu, H. I. (2003). Application of virtual reality technology in biology education. *Journal of Biological education*, 37(2), 71-74.
- Simon-Liedtke, J. T., & Baraas, R. C. (2022). The need for universal design of extended reality (xr) technology in primary and secondary education: Identifying opportunities, challenges, and knowledge gaps from the literature. in Virtual, Augmented and Mixed Reality: Applications in Education, Aviation and Industry: 14th International Conference, VAMR 2022, Held as Part of the 24th HCI International Conference, HCII 2022, Virtual Event, June 26–July 1, 2022, Proceedings, Part II (pp. 121-141). Springer.
- Smith, J. R., Snapp, B., Madar, S., Brown, J. R., Fowler, J., Andersen, M., Porter, C. D., & Orban, C. (2023). A smartphone-based virtual reality plotting system for stem education. *Primus*, 33(1), 1-15. https://doi.org/10.1080/10511970.2021.2006378

- Soliman, M., Pesyridis, A., Dalaymani-Zad, D., Gronfula, M., & Kourmpetis, M. (2021). The Application of virtual reality in engineering education. *Applied Sciences*, 11(6), 2879. https://doi.org/10.3390/app11062879
- Squire, K., & Jan, M. (2007). Mad city mystery: developing scientific argumentation skills with a placebased augmented reality game on handheld computers. *Journal of Science Education and Technology*, *16*(1), 5–29. http://dx.doi.org/10.1007/s10956-006-9037-z
- Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, 79(2), 625-649. https://doi.org/10.3102/0034654308325896
- Suh, W., & Ahn, S. (2022). Utilizing the metaverse for learner-centered constructivist education in the postpandemic era: An analysis of elementary school students. *Journal of Intelligence*, 10(1), 17. https://doi.org/10.3390/jintelligence10010017
- Sun, J., Gan, W., Chao, H. C., & Yu, P. S. (2022). Metaverse: Survey, applications, security, and opportunities. arXiv preprint, https://doi.org/10.48550/arXiv.2210.07990
- Tang, Y. M., Au, K. M., Lau, H. C., Ho, G. T., & Wu, C. H. (2020). Evaluating the effectiveness of learning design with mixed reality (MR) in higher education. *Virtual Reality*, 24(4), 797-807. https://doi.org/10.1007/s10055-020-00427-9
- Tran, N. C., Wang, J., Vu, T. H., & Wang J. C. (2022). Anti-aliasing convolution neural network of finger vein recognition for virtual reality (VR) human-robot equipment of metaverse. *The Journal of Supercomputing*, 3(79), 2767-2782. https://doi.org/10.1007/s11227-022-04680-4
- Verkijika, S. F., & De Wet, L. (2015). Using a brain-computer interface (BCI) in reducing math anxiety: Evidence from South Africa. Computers & Education, 81, 113-122. https://doi.org/10.1016/j.compedu.2014.10.002
- Vourvopoulos, A., & Liarokapis, F. (2014). Evaluation of commercial brain–computer interfaces in real and virtual world environment: A pilot study. *Computers & Electrical Engineering*, 40(2), 714-729. https://doi.org/10.1016/j.compedu.2014.10.002
- Wang, Y., Su, Z., Zhang, N., Liu, D., Xing, R., Luan, T.H., & Shen, X.S. (2022). A Survey on metaverse: Fundamentals, security, and privacy. *IEEE Communications Surveys & Tutorials*, 25(1), 319-352. http://doi.org/10.1109/COMST.2022.3202047
- Warburton, S. (2009). Second Life in higher education: Assessing the potential forand the barriers to deploying virtual worlds in learning and teaching. BJET - SpecialIssue: Out of This World: 3 - D MUVEs, 40(3), 414-426. https://doi.org/10.1111/j.1467-8535.2009.00952.x
- Wiecha, J., Heyden, R., Sternthal, E., & Merialdi, M. (2010). Learning in a virtual world: experience with using second life for medical education. *Journal of medical Internet research*, *12*(1), e1337.
- Wolpaw, J. R., Birbaumer, N., McFarland, D. J., Pfurtscheller, G., & Vaughan, T.M. (2002). Braincomputer interfaces for communication and control. Clin Neurophysiol: Off J Int Federat Clin Neurophysiol, 113, 67-791.
- Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education*, 62, 41-49.
- Yağcı, A., & Şentürk, C. (2023). Metaverse in science (physics-chemistry-biology) education. *EDUCA-TIONE*, 2(2), 264-290.
- Yağcı, A., & Şentürk, C. (2023, May). Investigation of teachers' competencies in using Web 2.0 tools. Latin America 6th International Conference on Scientific Researches, (pp. 520-533), Havana, Kuba.
- Yıldız, S. (2023). Reflection of metaverse and wearable technologies on adventure tourism: Metadventure tourism. International Journal of Commerce, Industry and Entrepreneurship Studies (Utisgad Journal), 3(1), 1-27.
- Yılmaz, R. M., Karaman, A., Karakuş, T. & Göktaş, Y. (2014). Elementary students' attitudes towards 3 dimensional virtual learning environments: Case of Second Life. *Ege Journal of Education*, 15(2), 538-555.
- Yoo, J. S., Patel, D. S., Hrynewycz, N. M., Brundage, T. S., & Singh, K. (2019). The utility of virtual reality and augmented reality in spine surgery. *Annals of translational medicine*, 7(Suppl 5). https://doi.org/10.21037/atm.2019.06.38
- Zhang, J., Lu, V., & Khanduja, V. (2023). The impact of extended reality on surgery: A scoping review. International Orthopaedics (SICOT) 47, 611-621. https://doi.org/10.1007/s00264-022-05663-z.
THE FUTURE OF HIGHER EDUCATION FROM A TRANSHUMANISTIC PERSPECTIVE: NOVEL PARADIGMS

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Abstract

Long time ago Ryle wanted his target audience to visualize, with a Gestalt-like understanding; the very unique being of universities- which may result in several ontological issues though, with the help of a striking scenario:

"A foreigner visiting Oxford or Cambridge for the first time is shown a number of colleges, libraries, playing fields, museums, scientific departments and administrative offices. He then asks 'But where is the University? I have seen where the members of the Colleges live, where the Registrar works, where the scientists experiment and the rest. But I have not yet seen the University in which reside and work the members of your University.' It has then to be explained to him that the University is not another collateral institution, some ulterior counterpart to the colleges, laboratories and offices which he has seen. The University is just the way in which all that he has already seen is organized. When they are seen and when their coordination is understood, the University has been seen". (Ryle 1949: 17– 18).

Today, considering the incredible speed of change it indeed is highly difficult to keep the finger on the pulse of the Zeitgeist for many. In this direction, speculating about the future of the modus operandi and the practicum pertaining to higher education institutions, the value and function of the education offered at tertiary level and beyond viz. through post graduate programs and thence the shifting roles and responsibilities emerging and gained in this regard make the already complex nature of universities far more complicated for all the parties and stakeholders. The ecosystem of university has altered much and nowadays, also ironically, subjects like the ethical sides of resorting to Artificial Intelligence (AI) e.g., for educational and academic purposes and

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whether AI will ultimately replace human beings, even academics provided it becomes more intelligent along with developing a form of consciousness are being debated in the lecture theatres that were once places where the doctrine of Determinism was disseminated. At this point the idea of Transhumanism comes into play as "not a static or crystallized doctrine" since "*it has already had its share of schisms and internecine skirmishes and rather it is better understood as a strange attractor that draws around itself an array of diverse techo-futurist views whose underlying unity rests in a common commitment to an optimistic and instrumentalist reading of technology and an informational conception of self" (Doede, 2009: 40).*

To this end, it will be a meaningful and purposeful endeavor to delve into the future of the idea(l) of university through this conceptual book chapter via looking from the perspective of Transhumanism by scrutinizing the new duties of universities as organizations with societal dimensions, by dwelling upon the instruction, namely, the teaching and learning processes to take place in and out of higher education institutions using Information Technologies (IT), and by means of discussing materializing epistemologies of innovative sort that help advance scientia.

Introduction

Transhumanism appears to have emerged quite recentl as a concept yet it is heavily influenced by the moral, political, and philosophical thoughts of the 19th century. The innovations and conveniences brought by technology have shaped people's perspectives on life, and the idea that a different form of the current world; a more autonomously operating one can exist has gained a momentum (Steinhoff, 2014). The basis of transhumanism practices lies in improving the quality of the life of people and to develop the global knowledge base (Köksal, 2019: 150).

Today, thanks to science and technology, people can instantly access information and communicate worldwide without time and space limitations. From this point of view, transhumanism practices should also be usable, testable, and applicable for the good of the society (Uğur, 2018: 61). In this respect, it can be clearly stated that the notion of transhumanism is not only a philosophical movement. Transhumanism, in other words, the philosophy of technology, is about how technology is actively used and how human beings transform with technology (Dağ, 2019). Alterations taking place in the world of technology indeed affect a fair number of areas of our lives. Education and training services are also impacted, and plentiful countries try to integrate technology and education through their attempts every year (Rapoport, 2014).

Whilst providing educational services traces-or more- of transhumanism are reflected in an inevitable fashion (Vinge, 2013). In recent years, in particular

machine learning, humanoid robots, innovative software, augmented reality, and new-generation artificial intelligence applications have been frequently used in trajectories of education (More & Natasha, 2013). Amongst these applications, artificial intelligence applications are the closest to transhumanism applications (More, 2013). This is because with artificial intelligence applications, personalisation of the learning process, intelligent tutoring systems, smart teachers and adaptive learning applications can be created and realized via integrating these into modus operandi. Transhumanistic approach assures that robots or intelligent technologies are expected to be able to make decisions and perform operations by thinking without the need for humans (Abramov & Yampolskiy, 2019). Howbeit, artificial intelligence applications can use an available dense data set and work with a limited algorithm. Ultimately, it can imitate human behaviours and exhibit unique behaviours at a limited level (Sharma, 2019: 2). Albeit a considerable number of theories produced at this juncture, in the end, this software will still result from a human algorithm and will not go beyond the human limit (Aksu, 2019).

As a matter of fact, the parameter entitled the human factor is significant in the provision of educational services (Istvan, 2019) since the ability to make judgements, instant decisions, and develop ideas according to the realsm and dynamics of a specific situation is often realised within a limited time. It may be deemed necessary to establish cause-and-effect relationships and blend them with human experience, especially in matters that require distinct uses of initiative (Misra, 2019). In the transhumanistic approach, these processes are thought to be quickly completed with augmented reality and artificial intelligence applications. These applications aim to reduce the physical workforce, enhance the welfare of people, and assure a richer and more effective learning environment (Eisenberg, 2018).

Transhumanism intends to go beyond biological limits by developing the boundaries of applied learning. This idea is planned to maximise human abilities and transfer them to machines. That said, although those who advocate transhumanism may have extreme ideas, they tend to adhere to realism as well. In this respect, those who advocate transhumanism actually differ from the Enlightenmentists (Damberger and Estella, 2017: 45). Those who support transhumanism advocate the transition from the human idea(l) to the "*posthuman*" concept. In other words, they imagine humans as beings developing themselves reaching beyond themselves i.e., humanity. The "*Human 2.0*" version is thought to be created by boosting human abilities and going beyond the borders with technological developments (Roberts, 2019).

The term of technological developments belonging to the 21st century is the understanding of "*digital transformation*". With digital transformation, improvements occur in dissimilar fields today (Bozkurt, 2019). Amongst these

areas where digital transformation is intensively experienced is again the spheres of education services. Nowadays, digital applications are carried out at diverse levels, from primary school to higher education (Karaman, 2019). Higher education is the level where digital applications are developed, and new technologies are produced along with being the lands where the information and knowledge brought about is heavily utilized. With the digital transformation in higher education, new-generation software, intelligent technologies, and various other applications are being used (Öngün, 2019). This change in higher education has its own place in the territories of transhumanism (Braidotti, 2013). Because the creation of posthuman beings with high technology production and the use of scientific methods required for this is realised mostly at the higher education level (Klichowski, 2015: 432).

When the transhumanism applications planned to be implemented in higher education are scrutinized, there appear ideas such as nanorobots that will augment the quality of life, gene mapping that claims to provide immortality in the long run controlling emotions and reducing psychological fatigue while expanding the capacity of brain reducing the 'difference' between human and machine applications producing beings such as robots and cyborgs that will facilitate human life, and ultimately creating a virtual application universe (Kruger, 2015; Uğur, 2018: 60). Higher education is the field where scientific studies and original applications are generated the most frequently in this era (Murris, 2016). With the Covid-19 pandemic, a severe isolation process has been experienced worldwide. In this isolation process, technological applications and digital transformations have been intensively realised not to disrupt the education services to be offered. This process lasted approximately three years and was conducted in line with the expectations of the views supporting the ilinking of transhumanism to educational services. Terminology like open, hybrid, flexible, and digital universities have come to the fore. At present, brain mapping, robotic coding, quantum computing, supercomputers, uncrewed autonomous vehicles and other innovative applications pave the way for the formation of trans-posthuman beings. In Figure 1 below, the innovations desired to be attained in this regard with transhumanistic perspectives are presented.



Figure 1. Innovations to be Realised in the Field of Education with Transhumanism

Figure 1 underpinnes that the quality of education services should be escalated with transhumanism, and the best technologies should be resorted to in the field. Acknowledging and embracing transhumanism approaches in educational services have started to become more visible in the 21st century (Snaza & Weaver, 2014). In particular pedagogical philosophy of science, new generation intelligent decision-making techniques, multi-criteria decision-making and machine learning applications, cyber-technology and neuroscience applications exhibit a gradual transition to transhumanism (Thomas, 2015). Transhumanism practices serve as a catalysing force in higher education respecting students' experiencing a richness of applications, developing their creativity, creating individual learning environments (Ayyıldız & Yılmaz, 2021), and expanding the use of artificial intelligence (Vannini, 2015). A good number of science fiction technologies we encounter in several forms of genre used to be found strange years ago yet so many of them have become a part of the realm. In fact, transhumanistic approaches attempt toward warranting the digital transformation of people and their evolution in a diversity of areas (Rotas, 2014). In this context, addressing higher education, which will play an intermediary role, specifically taking a transhumanistic outlook will definitely contribute to the accumulating literature. The future of the societal functions of universities, transhumanistic approaches in the education and training processes, the management of big data in higher education, legal limits and ethical

issues in artificial intelligence applications, sustainable development paradigms and digital transformation applications in higher education, artificial intelligence and values at stake in education are among the subject areas that are worthy of examining in this direction.

Social and Community Functions of Universities in the Future with Transhumanistic Perspectives

Arguably, higher education institutions have always had an essential and respected social position (Toğrol, 2012) as they have a mission that produces scientia, that seeks to conduct research and shape the future to enlighten and prosper the society. When this role undertaken by universities is duly fulfilled, it can be affirmed that social life functions more healthily, the society's awareness is raised, and its development is made continuous (Erdem, 2013). Universities are reliable institutions carrying out research to meet social development and social expectations (Çalık & Sezgin, 2005). Further to that, the presence of highly specialised scientists is a source of trust for the social community in solving a mass problem (Almaraz-Menendez et al., 2016). The best example to this is the Covid-19 pandemic, which threatened the whole world. During the Covid-19 pandemic, individuals expected answers from science and higher education institutions endeavored to find a cure and take the required scientific steps (Breque et al., 2021).

In recent years, developments in science and technology have also affected higher education institutions, and society's expectations have started to shift at this point (Massen et al., 2019). Universities are expected to execute more complex operations when approached from a transhumanistic perspective. It is clear that the digital transformations and the development of novel technologies have led to the emergence of unique needs and the formation of new professions. In this frame of reference, higher education institutions, where individuals receive education towards an occupation are meeting the needs of the new century (Rego et al., 2021). Universities facilitate new dimensions of their operating systems depending on technological developments and internalize digital transformation practicum (Serpa & Ferreira, 2019). To this end, all kinds of applications are carried out over the internet, open university and digital university applications and online courses are merely some of them (Sułkowski et al., 2021). Considering the society's expectations, changing demands, economic variables, paremetres of other sort and the lifestyle of Generation Z, it would be fair to state that transhumanistic approaches will enter our lives more in the near future (Hashim et al., 2021). Figure 2 demonstrates the results of the line of research on traditional classroom environments and digital classroom environments.



Figure 2. Traditional Classroom vs Distance/Virtual Classroom (URL-1, 2023)

As can be seen, digital classroom environments can provide students with a more flexible studying and working environment. In addition, there is no need for a physical classroom environment. 39% of students think that most of their education will take place in digital environments in the future. In view of this, it would be appropriate to pinpoint that universities will experience a severe transformation in the future (Vial, 2019). Moreover, universities will lead the formation of new departments and new specialisation areas with this transformation. There will be an increase in the demand for such departments like software engineering, robotics, coding, and computer engineering. Higher education institutions will play a vital role in a country's development both financially and socially vis-à-vis high technology production and creating qualified labour resources (VishneVsky et al., 2021). In light of all these developments, with a transhumanistic perspective, one can comfortably utter that a great number of problems stemming from rather utopian issues have become a reality over time, and expectations of differing sort will emerge and be met in the near future. Figure 3 casts light to the social innovation process for universities, businesses, policy makers and the private sector. As it seems, this process has a cyclical structure, and universities are kernel to it from the beginning of the process.



Figure 3. Social Innovation (SI) as a Process (Morawska-Jancelewicz, 2021)

Arfuably, there exist several preconceptions about the use of artificial intelligence applications. Among these, it is predominant that machines can never replace humans or cannot sympathize with others like humans do. It is also predicted that artificial intelligence applications will be insufficient for a considerable number of educational contexts, especially territories of higher education (Vakkuri & Abrahamsson, 2018). As a matter of fact, artificial intelligence applications work with a limited amount of data, and this prevents these systems from producing wholly original products. Howbeit, these prejudices can be broken from time to time with the advanced technologies and powerful algorithms emerging. The intensive data collection by the Internet and information technologies along with the active uses of big data can pave the way for the desired pathways for the development of artificial intelligence applications. Another issue pertaining to artificial intelligence applications is the increase in information theft and the lack of any sanctions in this regard. It is true that today, there is no legal penalty for the works produced with the usage of artificial intelligence. That said, higher education institutions use artificial intelligence control systems and additional algorithm-detecting software (Turnitin, Ithenticate, and alike) and attempt to take measures to prevent the misuses of artificial intelligence. At the same time, many universities organize awareness raising trainings and seminars for the effective use of artificial intelligence. Thanks to information technologies themselves ironically, these trainings are constantly available to students and all other stakeholders, namely, via e-mail, mobile phone applications and virtual environments. It is worth emphasizing herein that artificial intelligence is not a technology to be feared and that it can be used in numerous ways to benefit human beings.

Analysing Educational Processes in Universities with a Transhumanistic Perspective

Developments in technology in recent years have fostered transhumanistic thoughts to become more common. One of the areas where transhumanistic approaches come to life is the field of higher education (Randhawa & Jackson, 2020). In the field of higher education, the intensive use of artificial intelligence applications has strengthened the idea of transhumanism. This is entitled a kind of a revolution in the education and training process. When approached from the perspective of transhumanism, this situation, portrayed as a digital revolution, is associated with the results of referring to artificial intelligence applications (Zeide, 2019).

Artificial intelligence applications have initiated a unique period in higher education institutions. This due to the fact that those who adopt transhumanism approaches argue that artificial intelligence will play an active role in the future increasing student success. At the same time, it is underscored that artificial intelligence can take full responsibility of designing and delivering some work such as keeping student records, planning course content, and giving lectures (Stefan & Sharon, 2017). In general, this constitutes the thesis that "*artificial intelligence can strengthen universities when used correctly in higher education*".

Apparently, artificial intelligence applications have been situating themselves in universities (Mellul, 2018). That being said, it might be too early to capture the perspective of transhumanism in this setting, and there is a long way to go. This is on account of the fact that higher education institutions need to be involved in comprehensive planning deploying a systematic road map to be able to complete this digital transformation process as desired. At the same time, it is necessary to prepare the required legal grounds pertaining to financial, social, psychological and ethical aspects (Papaspyridis, 2020). There are disparate stakeholder groups in universities. Among these, those who have a direct relationship with the education and training process are students, civil servants, academics, and administrators. While digital transformation is being achieved, these stakeholders' computer, technology and digital literacy should also be improved (Berendt et al., 2020) to guarantee a smoother transition to be achieved with new mindsets and mentalities.

The use of artificial intelligence brings about a number of advantages in higher education trajectories. One of these advantages is the creation of individualized educational environments and the ability to manage educational processes in line with the learning pace of students (Shaikh et al., 2022). With artificial intelligence applications, individual deficiencies can be overcome, and positive developments can be experienced in the education of learners with special needs. However, artificial intelligence applications also cause inequalities of novel sort. Artificial intelligence applications call for a set of skills such as technology competence, socioeconomic opportunities, internet access opportunities. This may result in inequality in higher education. The individuals who have access to artificial intelligence applications can take advantage of these opportunities to improve themselves, for instance, in terms of cognition and hence can keep up with the age we live in (Sandu & Gide, 2019). On the other hand, the ones who do not have access are deprived of the opportunities and cannot even develop digital literacy to the fullest extent.

Artificial intelligence applications also provide support for many students respecting their personal development, language competence, and the development of creative and critical skills with the new solutions they offer. Thanks to grammar and content editors in the academic writing processes, it is possible for students to write more fluently. Besides, interpretation and reasoning skills are supported with critical thinking examples (Sevgi, Ayyıldız & Yılmaz, 2023). Artificial intelligence applications also positively affect students' academic and intellectual productivity. They also improve creative learning by developing many alternative solutions in a highly short time so that students will not experience burnout during such times (Van Den Berghe et al., 2019).

In the 21st century, artificial intelligence applications are frequently included in the concept of modern higher education (Carriço, 2018; Sevgi & Yılmaz, 2023). Increasing the function of higher education, making sure of a more competitive structure, reducing economic outputs and rising the number of technology-based applications are implications of the transhumanism perspective (Davies et al., 2017). Currently, studies on artificial intelligence applications in higher education are being taking place globally. Determining university curricula, personnel selection in recruitment, and the use of virtual environments (Metaverse) in university promotions are the most common subject areas (Zawacki-Richter et al., 2019). With that being said, the use of big data in university environments where millions of data are generated daily toward decision-making processes is another subject area. The acceleration of artificial intelligence applications in universities has resulted in several questions though. Will education be provided only with digital applications in the future? Will there be severe ethical limits in the use of artificial intelligence? We will see the answers to these questions shortly. Until then, studies will continue to improve the existing applications in the best way. While these discussions on artificial intelligence go on, it is observed that these said applications are becoming more and more popular in educational environments (Spector & Ma, 2019).

Some applications include preparing innovative classroom environments, creating individual learning environments and rich course content, preparing autonomous decision-making and response systems, and monitoring student absenteeism (Angeli & Valanides, 2019; Baker & Inventado, 2014). The use of artificial intelligence in higher education is generally taking place in two different areas. The first of these areas is related to management. To increase efficiency in management processes, artificial intelligence-based applications are used particularly in promotion and marketing processes, recruitment, student admission, in the regulation of financial outputs and risk analysis. The second area where artificial intelligence is employed in higher education is the interpretation and meaningfulisation of big data (Pence, 2019).

Artificial intelligence applications are preferred especially in areas such as analysing learning outcomes, controlling management systems, and storing academic data pools (Jackson, 2019). In addition to these areas, other areas where artificial intelligence is used in higher education are as follows (Taşçı & Çelebi, 2020):

- Preparing administrators, faculty, and students for the new digital world,
- To examine student admission and dropout processes in higher education,
- To develop psychosocial support practices by examining student support processes,
- To control academic achievement, active participation in lessons and feedback processes.

Educational Big Data in Higher Education

Educational big data significantly contributes to higher education institutions' competitiveness and also to their ability to make effective decisions. In this framework, the contribution of educational big data to institutional decisionmaking processes has been taken very seriously by higher education institutions in recent years (Daniel, 2017). The changes in information technologies now make it possible to record all data and transactions, supervize them, and then analyse them with the help of various algorithms (Akmeşe et al., 2021). These benefits provided by information technologies have supported the development of the awareness of big data in higher education institutions and contributed to educational systems' carrying learning processes to a higher level by using big data (Newman & Gough, 2020). The field of higher education faces ever-increasing data generation (Viloria et al., 2019). Developing technologies, new applications, smart devices, and many other factors play a leading role in data production and data diversification (Zhang et al., 2015). Unlike the traditional classroom environment, higher education services offered in digital environments have reduced the interaction between students and teachers, but they have managed to overcome the related shortcomings with the features such as recording and offering the repeated viewing of course content (Gao & Zhang, 2018). The diversity of applications in the higher education process and the more intensive use of digital applications have led to the emergence of issues such as storing and preserving the relevant data and to those that pertain to improving the quality of education (Daniel, 2015). However, new areas, such as the concept of big data and the use of big data, have come into play here. In that sense, the data produced in educational services is called "*educational big data*". The primary purpose of obtaining, preserving, and analysing educational big data in higher education is to find the components that affect learning processes and to include them effectively in the learning process (Bozkurt, 2017). There are many areas where educational big data is benefitted from in higher education. Figure 4 exhibits the areas where educational big data is mainly used in higher education.

Use of Big Data in Higher Education



Figure 4. Use of Big Data in Higher Education

It is noteworthy that these are not the sole areas where big data is used in higher education (Cuillandre, 2020). The uses can also be expressed as student acquisition, analysing student and administrator behaviours, measuring and evaluating teaching quality, total self-evaluation of the institutional structure, forecasting the academic and professional performance of all relevant stakeholders, confirming that teaching processes are prepared for adaptive learning, preventing dropout by identifying student profiles, career planning and identifying possible future occupational groups, providing infrastructure services for individual education environments, receiving evidence-based feedback, planning and improving the education curriculum, and finally guiding quality and accreditation practices (Coleman, 2019).

The Use of Artificial Intelligence in Higher Education from a Transhumanistic Perspective and Its Legal Limits

Innovations in information technologies have begun to move information from areas that people frequently use to new areas they have never known. At the same time, this information transfer is carried out faster by millions of people all over the world who have internet access (Ashri, 2020). This has accelerated the creation of millions of data and a priceless data pool. Over time, these data have turned into algorithmic structures that are entitled artificial intelligence and use human patterns (Girasa, 2020). Especially in higher education, the use of artificial intelligence and its derivatives are on the increase (Varghese & Mandal, 2021). However, artificial intelligence applications have many negative features as well as the advantages they potentially offer. Many undesired acts such as fake data production can be done quickly with artificial intelligence applications. A draft law or law content has not hitherto been prepared on this subject. Nevertheless, many countries have announced that they have started to determine artificial intelligence applications' use and legal limits (UNICEF, 2020).

The use of artificial intelligence in education has three different dimensions. These pillars are expressed as the economic power and legal limits adopted by countries, the artificial intelligence applications adopted by legislators, and the type of artificial intelligence the governments want individuals to access. Besides, it is not easy to establish a relationship between higher education and artificial intelligence. Because artificial intelligence technology can both vary according to economic differences among students and create inequalities in the tasks that students must enact (Popenici & Kerr, 2017). At the same time, this is also valid for academics in higher education. Today, an 'academic' paper can be produced in minutes with artificial intelligence. These results pave the way for labour theft, ethical problems, and unfair success through nonscientific acts. Currently, many artificial intelligence software uses scanners to examine whether the operations performed are done with artificial intelligence, ironically again using the media of artificial intelligence. Especially in higher education, "Turnitin" and "Ithenticate" programmes have started to control academic content by integrating an "Artificial Intelligence Detector" application into their systems. The concerns about artificial intelligence in higher education are not limited to these. Further to these, the following legal issues should be taken into consideration (Vacarelu, 2023):

- 1. Artificial intelligence applications should be used to facilitate people's work and help the development of their mental skill capacities. Work and transactions should not be done by replacing the human mind with only artificial intelligence.
- 2. There should be no limitations on ethical practices in artificial intelligence. In other words, ethical concerns should not be carried only on specific issues. Because artificial intelligence applications have a fea-

ture that increases its capacity daily and can adapt itself quickly to novel environments. Therefore, the framework of the ethical problems should be kept broad.

- 3. Using artificial intelligence technology in higher education requires a costly and lengthy transformation process. For this reason, legal preparations should be made for the optimal transition to artificial intelligence applications, draft laws should be prepared, and these should be placed on legal grounds within a common consensus with universal validity.
- 4. Legal intelligence applications differ according to departments and fields in higher education. For this reason, to adapt to artificial intelligence applications more quickly, some legal regulations should be implemented at the high school level.
- 5. Artificial intelligence applications are mainly used on digital platforms. This situation will turn off the physical environment of universities, and over time, universities will turn into environments where only exams are held. Thus, there will be downsizing and restructuring of universities. This will have significant patrimonial and fiscal consequences for educational institutions. As a result, the existing regulations will need to be replaced, and new legal applications will be needed.
- 6. The use of artificial intelligence will cause extraordinary differences in the level of development of countries' economies in the coming decades. This will lead to global change and the emergence of new organisations.

The relevant line of literature portrays the following themes, categories and codes that are intensively resorted to when studying the uses of these applications.

Theme	Category	Code
Ethical dimen- sions that AI applications should own	Legal	Open data processing
		Compliance with the law
		Transparency of data collection policies
		Emphasis on privacy and equality
	Moral	No sharing of personal data
		Underlining value judgments
		No producing of information pollution
		Presenting accurate information
Importance		Almost full
attached to the		Partial
ethical dimen-	Significance level	
sion of AI ap-		Not at all
plications		

Usage areas of AI applications	Doing homework	Project preparations
	and assign-	Creating creative apps
	ments/tasks	Solving complex problems
	Curiosity and dis- covery	Discovering topics one's curious about
		Doing research
		Accessing unlimited information

The Ethical Dimension of Artificial Intelligence Use in Higher Education with a Transhumanistic Perspective

When approached from a transhumanistic perspective, artificial intelligence applications have provided many educational conveniences (Becker et al., 2018). This points to many new opportunities for both students and academics. However, artificial intelligence applications can negatively affect the performance of students and academics, their gaining experience and, most importantly, their creative thinking skills. As a result, unethical behaviours will become more frequent and unethical situations such as gaining unfair success will be more common (Jalal et al., 2021). Although artificial intelligence applications are still new, they have a systematic and developing usage area in higher education. In artificial intelligence applications where individual use is intense, the learning process is individualised, and collective work is often out of the question. At the same time, the lack of any law or regulation for artificial intelligence applications encourages the use of these applications in an unlimited and illegal manner (Holmes et al., 2021). Artificial intelligence applications in higher education allow you to write poetry, draw, prepare a presentation, or produce scientific content on any subject. You can even solve a problem you cannot solve in a few seconds (Ouyang et al., 2022). Even though this may seem like a very positive novelty, it is not favourable. Because the primary purpose of artificial intelligence applications is to help people improve their mental skills. On the other hand, many studies indicate that artificial intelligence applications create behavioural changes in students after a certain period, making them more impatient engaged in less thinking. This causes them to experience laziness in their thinking processes and dull their creativity (Borenstein & Howard, 2021).

Another aspect of the use of artificial intelligence applications in higher education is the collection of personal data. Because while using these applications, all kinds of information are entered into the system, and unlimited data collection is made possible. The fact that there is no legal ground on this issue creates a legal gap among the companies that prepare such applications and causes your data to be collected easily. This also results in privacy violations, biased data creation, and statistical apophenia (Sacharidis et al., 2020). Artificial intelligence applications are referred to consciously and willingly. Thereupon, the users do not develop prejudice against issues like the collection of personal data. What is more, the intense curiosity of students and other stakeholders in higher education allows these innovative technologies to collect data generously. Whilst this does not pose a problem for the collection and processing of personal data for now, it may cause serious problems such as data theft and disclosure of personal life in the coming years (Irwin et al., 2021). Considering the transhumanism perspective, the activities of these applications can be seen as ordinary and necessary. Because all these aim at humanising machines at an advanced level and to have these machines do all the work for humans and instead of humans in the future. However, when the ethical issue is taken into account, there should inevitably be certain legal limits. Another dimension is Transhumanism, which intends to make machines serve people and increase the welfare of people. However, today, in a paradoxical way, artificial intelligence applications in higher education make people more dependent on machines as their thinking skills weaken (Slade & Prinsloo, 2013).

Higher education aims to train qualified individuals and to contribute to the labour force of people who are experts and professionals in their fields. However, artificial intelligence applications might prevent the formation of a qualified labour force because they can easily do a lot of work quickly. University students can easily get them to write their term papers, do research projects from where they sit without any spending of time, labour, or money. This may reduce quality to the great extent though. At the same time, accountability and transparency are essential issues in higher education. Every activity should be carried out in line with a specific criterion. However, unfortunately, artificial intelligence applications store all their data and do not share any working principles (Wang & Cheng, 2021) making it almost impossible. Thereupon, necessary legal procedures should be prepared as soon as possible, and a legal standard of use should be established internationally.

In recent years, artificial intelligence applications have gained a prominent place in the field of education. Higher education institutions are also using these technologies to improve students' learning, enhance efficiency and provide easy access to information (Akgun & Greenhow, 2022). That said, the mind-boggling pace of these applications has brought along some concerns and ethical problems (Cath et al., 2018). Some of these include equality, privacy, data security, transparency, accountability, fairness, nonmaleficence, confidentiality, unlimited access to information, freedom, reputation, sustainability, and information pollution (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2021). In this context, it would be an important step to srutinize the ethical dimensions of artificial intelligence applications in higher education and to offer solutions via drawing attention to important problems. In addition to these, increasingly powerful human-artificial intelligence

gence collaborative environments may cause young people to develop contraindications when it comes to educational, social, emotional, cognitive, cultural and political matters. This in fact necessitates an understanding that entails decolonized and "humanized posthuman" ethics (Adams et al., 2023).

The use of artificial intelligence applications constructs paths toward significant contributions in terms of how education should be delivered and how to improve the changing roles of instructors (Hern'andez-Orallo & Vold, 2019). There is albeit an issue that should be kept in mind at this juncture. This issue is ethics. As for ethics, how the activities are conducted rather than the outcomes of these comes to the fore. For this very reason, it should be discussed how artificial intelligence applications need to be made use of in the field of education and within spheres of teaching and learning and what ethical situations they may violate. When the literature is examined in this direction, it is clear that artificial intelligence applications can cause ethical problems in the areas of privacy and data breach, equality and fair use, personal development, bias and discrimination, human-machine relationship, freedom of opinion and thought, and autonomy (Jobin et al., 2019). This actually makes it imperative to establish a moral and legal framework for controlling these applications, determining access limits, producing legal content and freedom of use. There are a series of international initiatives for (more) ethical uses of AI applications. The literature review points to four different ethical documents in the field of education. These were as follows, respectively (Adams et al., 2023):

- 1. World Economic Forum (2019): Generation AI: Establishing Global Standards for Children and AI,
- 2. The Institute for Ethical AI in Education (IEAIED, 2021): *The Ethical Framework for AI in Education,*
- 3. UNESCO (2021): AI and Education: Guidance for Policymakers,
- 4. (UNICEF, 2021): Policy Guidance on AI for Children.

As can be seen, there is not yet an internationally accepted standard or sanctioning power agreed on by all the countries towards the use of artificial intelligence applications. To this end, this issue remains intensely topical and it is inevitable that serious steps will be taken in the near future.

Conclusion

This study examines the future of higher education, artificial intelligence applications and the expectations of those who adopt the transhumanism approach from many different perspectives. As a result of this study, it is necessary to direct some questions for all of us and to all of us. To what extent is higher education ready for transhumanism applications? To what extent do artificial intelligence applications support the transhumanism view? What should be the limits and ethical dimensions of using artificial intelligence in higher education? As can be seen, many questions come to mind. Although most of these questions will be answered in the near future, there will still be hesitations bearing in mind specific dimensions.

It is then necessary to approach the situation not with a dreamer approach but with a realist perspective with defined boundaries. For this reason, making the following preparations in higher education in the future will contribute to the formation of positive results (Taşçı & Çelebi, 2020):

- 1. Higher education institutions should establish their own internal artificial intelligence policies by national and international frameworks and support the practices in this field.
- 2. A SWOT analysis of artificial intelligence should be made by organising collaborations in the field of higher education and being prepared for the situations that may be encountered in the future.
- 3. Frequent information training, promotions, and awareness practices should be carried out to improve internal and external awareness of artificial intelligence.
- 4. Higher education institutions should include artificial intelligence in their on-campus and off-campus applications and popularise their use.
- 5. Special units should be established to control artificial intelligence applications in higher education, and the activities should be implemented within a specific procedure.
- 6. Big data applications are an essential issue in higher education. Big data applications supported by artificial intelligence should be used for higher education institutions to make more effective decisions on topics of international student admission, dropout, employee performance and distance education issues.
- 7. It should be ensured that all necessary information, such as the use of artificial intelligence in higher education, the content, purpose, and the storage conditions of the collected data, are specified and that these data are processed by obtaining consent.

Practical Implications

- 1. Transhumanistic understandings in relation to the future of higher education entail welcoming interdisciplinary approaches. Thusly, it will be important to highlight cooperation and collaboration in this sense by the members of a diversity of fields from social sciences to natural and physical sciences to better contemplate all the dimensions of the issue, namely, social, technical, administrative and pedagogical aspects of the subject.
- 2. To speak of inviting transhumanism for the use of all stakheolders of universities including learners, an egalitarian approach is required to support equitable and realistic ways of utilizing what it brings about

like the integration of artificial intelligence and the usage of Big Data. Hence, these stakeholders need to bet together and exchange ideas and experiences at micro level (departmental, organizational) and macro level (national, regional and international) gatherings of formal and informal sort.

REFERENCES

- Abramov, P.S., & Yampolskiy, R.V. (2019). Automatic IQ estimation using stylometric methods. In S. Sisman-Ugur, & G. Kurubacak (Eds.), Handbook of Research on Learning in the Age of Transhumanism (pp. 32-45). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch004
- Adams, C., Pente, P., Lemermeyer, G., & Rockwell, G. (2023). Ethical principles for artificial intelligence in K-12 education. *Computers and Education: Artificial Intelligence*, 4, 100131, 1-10. https://doi.org/10.1016/j.caeai.2023.100131
- Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. AI and Ethics, 2, 431-440. https://doi.org/10.1007/s43681-021-00096-7
- Akmeşe, Ö.F., Kör, H., & Erbay, H. (2021). Use of machine learning techniques the forecast of student achievement in higher aducation. *Information Technologies and Learning Tools*, 82(2), 297-311.
- Aksu, O. (2019). Artificial intelligence in the era of transhumanism smart phones. In S. Sisman-Ugur, & G. Kurubacak (Eds.), Handbook of Research on Learning in the Age of Transhumanism (pp. 157-170). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch010
- Almaraz-Menendez, F., Maz-Machado, A., & Lopez-Esteban, C. (2016). University strategy and digital transformation in higher education institutions. A documentary analysis. *International Journal of Advanced Research*, 4(10), 2284–2296.
- Angeli, C., & Valanides, N. (2019). Developing young children's computational thinking with educational robotics: An interaction effect. *Comput. Hum. Behav.*
- Ashri, R. (2020). The AI-Powered workplace: How artificial intelligence, data, and messaging platforms: Are defining the future of work. Apress Springer Group.
- Ayyıldız, P., & Yılmaz, A. (2021). 'Moving the kaleidoscope' to see the effect of creative personality traits on creative thinking dispositions of pre-service teachers: The mediating effect of creative learning environments and teachers' creativity fostering behavior. *Thinking Skills and Creativity*, 41, 100879, 1-10. https://doi.org/10.1016/j.tsc.2021.100879
- Baker, R.S., & Inventado, P. S. (2014). Educational Data mining and learning analytics. J. A. Larusson, & B. White (Ed.), In Learning analytics: From research to practice (pp. 61-75). New York: Springer.
- Becker, S. A., Brown, M., Dahlstrom, E., Davis, A., DePaul, K., Diaz, V., & Pomerantz, J. (2018). NMC Horizon Report: 2018 Higher Education Edition. Educause. https://library.educause.edu/~/media/files/library/2018/8/2018horizonreport.pdf
- Berendt, B., Littlejohn, A., & Blakemore, M. (2020): AI in education: Learner choice and fundamental rights. *Learning, Media and Technology*, 1-13. https://doi.org/10.1080/17439884.2020.1786399
- Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, 1(1), 61-65. https://doi.org/10.1007/s43681-020-00002-7

- Bozkurt, A. (2017). Türkiye'de uzaktan eğitimin dünü, bugünü ve yarını. Açıköğretim Uygulamaları ve Araştırmaları Dergisi, 3(2), 85-124.
- Bozkurt, A. (2019). From distance education to open and distance learning: A holistic evaluation of history, definitions, and theories. In S. Sisman-Ugur, & G. Kurubacak (Eds.), *Handbook of Research on Learning in the Age of Transhumanism* (pp. 252-273). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch016
- Braidotti, R. (2013). The posthuman. Cambridge: Polity.
- Breque, M., De Nul, L., & Petridis, A. (2021). Industry 5.0, towards a sustainable, human-centric and resilient European industry. *European Commission, Directorate-General for Research and Innovation*.
- Carriço, G. (2018). The EU and artificial intelligence: A human-centred perspective. *European View, 1* (17), 29-36. https://doi.org/10.1177/1781685818764821
- Cath, C., Wachter, S., Mittelstadt, B., Tadder, M., & Floridi, L. (2018). Artificial Intelligence and the 'good society': the US, EU, and UK approach. *Sci. Eng. Ethics*, 24, 505– 528.
- Coleman, F. (2019). A human algorithm: How artificial intelligence is redefining who we are. Counterpoint Press Perseus Group.
- Cuillandre, H. (2020). Après l'intelligence artificielle et la robotisation. Remettre l'humain au coeur du monde. Maxima.
- Çalık, T., & Sezgin, F. (2005). Küreselleşme, bilgi toplumu ve eğitim. Gazi Üniversitesi Kastamonu Eğitim Dergisi, 13(1), 55-66.
- Dağ, A. (2019). About information and education in trans-posthumanist process. ISophos: International Journal of Information, Technology and Philosophy, 2(3), 131-141.
- Damberger, T., & Estella H. (2017). Is pedagogy transhuman? Reflections on the relationship between pedagogy and transhumanism. *Articles and Dissertations*, 20, 41-56.
- Daniel, B. (2015). Big data and analytics in higher education: Opportunities and challenges. British Journal of Educational Technology, 46, 904–920.
- Daniel, B.K. (Ed.). (2017). Big data and learning analytics in higher education: Current theory and practice. Springer International Publishing.
- Davies, A., Dodgson, M., & Gann, D. (2017). Innovation and flexibility in megaprojects: A new delivery model. (B. Flyvbjerg, Dü.) Oxford: The Oxford Handbook of Megaproject Management, Oxford University Press.
- Doede, R. (2009). Transhumanism, technology, and the future. *The Appraisal Journal*, *7*, 39-54.
- Eisenberg, M. (2018). Transhumanism and education: Embodied learning in an era of altered bodies.s.1823-1824.15.06.2023.

https://repository.isls.org/bitstream/1/861/1/507.pdf

- Erdem, A.R. (2013). Changing roles and missions of university in information society. *Journal of Higher Education*, 3(2), 109-120.
- Gao, Y., & Zhang, S. (2018). Design of and research on autonomous learning system for distance education based on data mining technology. *Educational Sciences: Theory* & Practice, 18(6), 2633-2640. https://doi.org/10.12738/estp.2018.6.163

- Girasa, R. (2020). Artificial intelligence as a disruptive technology. economic transformation and government regulation. Palgrave Macmillan
- Hashim, M.A.M., Tlemsani, I., & Matthews, R. (2021). Higher education strategy in digital transformation. *Education and Information Technologies*, 27, 3171-3195. https://doi.org/10.1007/s10639-021-10739-1
- Hern´andez-Orallo, J., & Vold, K. (2019). AI extenders: The ethical and societal implications of humans cognitively extended by AI. In *In Proceedings of the 2019* AAAI/ACM Conference on AI, ethics, and society (pp. 507–513). https://dl.acm.org/do i/pdf/10.1145/3306618.3314238
- Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2021). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*. https://doi.org/10.1007/s40593-021-00239-1
- Irwin, J., Dharamshi, A., & Zon, N. (2021). Children's privacy in the age of artificial intelligence. CSA Group. [Online:https://www.csagroup.org/wp-content/uploads/CSA-Group-Research-Children_s-Privacy-in-the-Age-of-Artificial-Intelligence.pdf]. Retrieved Date: 19.03.2023
- Istvan, Z. (2019). According to Zoltan Istvan: Transhumanism and future. In S. Sisman-Ugur, & G. Kurubacak (Eds.), Handbook of Research on Learning in the Age of Transhumanism (pp. 28-31). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch003
- Jackson, S. S. (2019). Using artificial intelligence to improve access to and success in higher education. *INSIGHT Into Diversity*, 34-36.
- Jalal, S., Parker, W., Ferguson, D., & Nicolaou, S. (2021). Exploring the role of artificial intelligence in an emergency and trauma radiology department. *Canadian Association* of *Radiologists Journal*, 72(1), 167-174. https://doi.org/10.1177/0846537120918338
- Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence*, *1*, 389-399. https://doi.org/10.1038/s42256-019-0088-2
- Karaman, F. (2019). Ethical issues in transhumanism. In S. Sisman-Ugur, & G. Kurubacak (Eds.), Handbook of Research on Learning in the Age of Transhumanism (pp. 98-115). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch007
- Klichowski, M. (2015). Transhumanism and the idea of education in the world of cyborgs, ed. H. Krauze-Sikorska ve M. Klichowski vd., The educational and social world of a child. Discourses of Communication, Subjectivity and Cyborgization içinde, ss. 431-438, Poznan: Adam Mickiewicz University Press.
- Köksal, H. (2019). 2023 Eğitim vizyon belgesi, tekillik ve transhümanizm. Eğitim ve Toplum Araştırmaları Dergisi, 1, 145-157.
- Kruger, F. (2015). Experimenting with nomadic posthumanism: conceptualising education and rural learning ecologies differently. *Alternation Special Edition*, 16, 329–345.
- Massen, P., Andreadakis, Z., Gulbrandsen, M., & Stensaker, B. (2019). The place of universities in society. Global University Leaders Council Hamburg.
- Mellul, C. (2018). Emerging technologies in higher education and the workplace: An assessment. *International Federation of Catholic Universities*.

- Misra, P. K. (2019). The Role, influence, and demand of pedagogies in the age of transhumanism: Critical reflections. In S. Sisman-Ugur, & G. Kurubacak (Eds.), *Handbook of Research on Learning in the Age of Transhumanism* (pp. 171-184). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch011
- Morawska-Jancelewicz, J. (2021). The role of universities in social innovation within quadruple/quintuple helix model: Practical implications from polish experience. *Journal of the Knowledge Economy, 13,* 2230–2271. https://doi.org/10.1007/s13132-021-00804-y
- More, M. (2013). The Philosophy of transhumanism. In The transhumanist reader, 3-17.
- More, M., & Natasha, V.M. (2013, Eds.). The transhumanist reader: Classical and contemporary essays on the science, technology, and philosophy of the human future. New York: Wiley-Blackwell.
- Murris, K. (2016). The posthuman child: Educational transformation through philosophy with picturebooks. Abingdon: Routledge.
- Newman, M., & Gough, D. (2020). Systematic reviews in educational research: methodology, perspectives and application. In O. Zawacki-Richter, M. Kerres, S. Bedenlier, M. Bond, K. & Buntins (Eds.), Systematic reviews in educational research: Methodology, perspectives and application (pp. 3-22). Wiesbaden: Springer VS.
- Öngün, E. (2019). An evaluation of transhumanist bill of rights from current and future perspective: The adventure of technohumanism and rights. In S. Sisman-Ugur, & G. Kurubacak (Eds.), *Handbook of Research on Learning in the Age of Transhumanism* (pp. 346-362). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-8431-5.ch021
- Papaspyridis, A. (2020). AI in higher education: Opportunities and considerations. Microsoft Asia News Center. 11.07.2023. https://news.microsoft.com/apac/2020/ 03/26/ai-in-higher-education-opportunities-and-considerations/
- Pence, H.E. (2019). Artificial intelligence in higher education: New wine in old wineskins? Journal of Educational Technology Systems, 48(1), 5-13. https://doi.org/ 10.1177/0047239519865577
- Popenici, S.A.D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *RPTEL*, 12, 22. https://doi.org/ 10.1186/s41039-017-0062-8
- Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. Education and Information Technologies, 1-33. https://doi.org/10.1007/s10639-022-10925-9
- Randhawa, G., & Jackson, M. (2020). The role of artificial intelligence in learning and professional development for healthcare professionals. *Healthcare Management Forum*, 33(1), 19-24.
- Rapoport, M. (2014). Intelligent technologies and lost life: Concealing/revealing human absence through technology in three contemporary films. *Journal of Evolution & Technology*, 24, 17-28.
- Rego, B., Javantilal, S., Ferriera, J.J., & Carayannis, E. G. (2021). Digital transformation and strategic management: A systematic review of the literature, *Journal of the Knowledge Economy*.

- Roberts, R. (2019). Transhumanism and education. 01.07.2023. https://medium.com/ awecademy/ transhumanism-and-education-51569c73347b
- Rotas, N. (2014). Ecologies of praxis: Teaching and learning against the obvious. In Snaza, N. and Weaver, J. (Eds.). Posthumanism and educational research, (pp.75-83). New York: Routledge.
- Ryle, G. (1949). The concept of mind. London: Penguin Books.
- Sacharidis, D., Mukamakuza, C. P., & Werthner, H. (2020). Fairness and diversity in social-based recommender systems. In Adjunct Publication of the 28th ACM Conference on User Modeling, Adaptation and Personalization (pp.83-88). https://doi.org/10.1145/3386392.3397603
- Sandu, N., & Gide, E. (2019, September). Adoption of AI-Chatbots to enhance student learning experience in higher education in India. In 2019 18th International Conference on Information Technology Based Higher Education and Training (ITHET) (pp. 1-5). IEEE.
- Serpa, S., & Ferreira, C. M. (2019). Society 5.0 and sustainability digital innovations: A social process. Journal of Organizational Culture, Communications and Conflicts, 23(1), 1-14.
- Sevgi, M., Ayyıldız, P., & Yılmaz, A. (2023). Eğitim bilimleri alanında yapay zekâ uygulamaları ve uygulamaların alana yansımaları. Ö. Baltacı (Ed.). Eğitim Bilimleri Araştırmaları-IV içinde (ss.1-18). Gaziantep: Özgür Yayınları.
- Sevgi, M., & Yılmaz, A. (2023). Yükseköğretimde dijital dönüşüm ve metaverse. Y. Doğan ve N. Şen Ersoy (Edts.). Eğitimde Metaverse Kuram ve Uygulamalar içinde (ss.71-86). İstanbul: Efe Akademi Yayınları.
- Shaikh, A.A., Kumar, A., Jani, K., Mitra, S., García-Tadeo, D.A. & Devarajan, A. (2022). The role of machine learning and artificial intelligence for making a digital classroom and its sustainable impact on education during COVID-19. *Mater. Today Proc.* 56, 3211–3215.
- Sharma, R. C., Kawachi, P., & Bozkurt, A. (2019). The landscape of artificial intelligence in open, online and distance education: Promises and concerns. *Asian Journal* of Distance Education, 14(2), 1-2.
- Slade, S., & Prinsloo, P. (2013). Learning Analytics: Ethical Issues and Dilemmas. American Behavioral Scientist, 57(10), 1510-1529. https://doi.org/10.1177/ 0002764213479366
- Snaza, N., & Weaver, J. (2014). Introduction: Education and the posthumanist turn. In Snaza, N. and Weaver, J. (Eds.). *Posthumanism and educational research*, (pp.1-14). New York: Routledge.
- Spector, J. M., & Ma, S. (2019). Inquiry and critical thinking skills for the next generation: From artificial intelligence back to human intelligence. *Smart Learning Environments*, 6(8), 1-11. https://doi.org/10.1186/s40561-019-0088-z
- Stefan, A.D., & Sharon, K. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 1, 3-13. https://doi.org/10.1186/s41039-017-0062-8
- Steinhoff, J. (2014). Transhumanism and marxism: Philosophical connections. Journal of Evolution & Technology, 24, 1-16.

- Sułkowski, Ł., Kolasinska-Morawska, K., Seliga, R., & Morawski, P. (2021). Smart learning technologization in the Economy 5.0-The Polish perspective. *Applied Sci*ence, 11, 5261. https://doi.org/10.3390/app11115261
- Taşçı, G., & Çelebi, M. (2020). Eğitimde yeni bir paradigma: Yükseköğretimde yapay zekâ. OPUS–Uluslararası Toplum Araştırmaları Dergisi, 16(29), 2346-2370. https://doi.org/10.26466/opus.747634
- The Institute for Ethical AI in Education (IEAIED) (2021). *The ethical framework for AI in education*. University of Buckingham. [Online: https://www.buckingham.ac.uk/wp-content/uploads/2021/03/The-Institute-for-Ethical-AI-in-Education-The-Ethical-Framework-for-AI-in-Education.pdf]. Retrieved Date: 09.02.2023
- Thomas, M. C. (2015). Transhumanism in higher education: Social implications and institutional roles. Proceedings of the Symposium on Emerging Technology Trends in Higher Education. 12.06.2023. https://epubs.utah.edu/index.php/emerge/article/ view/1362
- Toğrol, E. (2012). Üniversitelerdeki gelişim: Britanya yükseköğretim sistemi, Yükseköğretim Dergisi, 2(1), 56-59.
- Uğur, S. (2018). Transhümanizm ve öğrenmedeki değişim. Açıköğretim Uygulamaları ve Araştırma Dergisi, 3, 58-74.
- United Nations Educational, Scientific and Cultural Organization (UNESCO) (2021). AI and education: Guidance for policy makers. https://unesdoc.unesco.org/ark:/48223/ pf0000376709
- UNICEF. (2020). Our Europe, our rights, our future. 16.07.2023. https://www.unicef.org/eu/media/1231/file/Report%20%22Our%20Europe,%20O ur%20Rights,20Our%20Future%22% 20.pdf
- UNICEF (2021). *Policy guidance on AI for children* 2.0. [Online: https://www.unicef.org/globalinsight/media/2356/file/UNICEF-Global-Insight-policy-guidance-AI-children-2.0-2021.pdf]. Retrieved Date: 21.02.2023
- URL-1 (2023). Future universities. 11.07.2023. https://www.linkedin.com/pulse/ gelece%C4%9Fin-%C3%BCniversiteleri-muge-aydinincecik/?originalSubdomain=tr
- Vacarelu, M. (2023). Artificial intelligence and higher education legal limits. F. Roumate (Edt.). In Artificial Intelligence in Higher Education and Scientific, (pp.15-33). Springer Nature.
- Vakkuri, V., & Abrahamsson, P. (2018). The key concepts of ethics of artificial intelligence. In Proceedings of the 2018 IEEE international conference on engineering, technology and innovation (pp. 1–6).
- Van Den Berghe, R., Verhagen, J., Oudgenoeg-Paz, O., Van Der Ven, S. H., & Leseman, P. P. (2019). Social robots for language learning: A Review. *Review of Educational Re*search, 89(2), 259–295. https://doi.org/10.3102/0034654318821286
- Varghese, N.V., & Mandal, S. (2021). Teaching learning and new technologies in higher education. Springer.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. Journal of Strategic Information Systems, 28(2), 118–144.

- Viloria, A., López, J.R., Payares, K., Vargas-Mercado, C., Duran, S.E., Hernández-Palma, H., & David, M. A. (2019). Determinating student interactions in a virtual learning environment using data mining. *Procedia Computer Science*, 155, 587–592. https://doi.org/10.1016/j.procs.2019.08.082
- Vinge, V. (2013). Technological singularity. The Transhumanist Reader, 365-375.
- VishneVsky, V.P., Harkushenko, O., Zanizdra, M.Y., & Kniaziev, S.I. (2021). Digital and green economy: Common grounds and contradictions. *Science and Innovation*, 17(3), 14–27. https://doi.org/10.15407/scine17.03.014
- Wang, T., & Cheng, E.C.K. (2021). An investigation of barriers to Hong Kong K-12 schools incorporating Artificial Intelligence in education. *Computers and Education: Artificial Intelligence*, 2, 100031. https://doi.org/10.1016/j.caeai.2021.100031
- World Economic Forum. (2019). Generation AI: Establishing global Standards for children and AI. [Online:https://www.weforum.org/reports/generation-ai-establishingglobal-standards-for-children-and-ai]. Retrieved Date: 23.03.2023
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Educational Technology in Higher Education*, 16(39), 1-27. https://doi.org/10.1186/s41239-019-0171-0
- Zeide, E. (2019). Artifical intelligence in higher education: Applications, promise and perils, and ethical questions. *EDUCAUSE*, 1-13. 28.06.2023. https://er.educause.edu/artcles/2019/8/artfcal-ntellgence-n-hghereducatonapplcatons-promse-and-perls-and-ethcal-questons
- Zhang, X., Gao, Y., Yan, X., de Pablos, P. O., Sun, Y., & Cao, X. (2015). From elearning to social-learning: Mapping development of studies on social mediasupported knowledge management. *Computers in Human Behavior*, 51, 803-811.