



STUDENT REPORT

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Influence of LLMs on
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Abstract:

Large language models (LLMs) and ChatGPT in particular, have recently skyrocketed in popularity and application, not least in education. This study intends to investigate how LLMs influence higher education teaching and learning. It covers a range of topics, including their present usage, how they affect different academic disciplines, and how the landscape of educational quality is evolving. For this, both students and professors are surveyed and interviewed respectively. For the discussion, theories of social constructivism, connectivism, and diffusion of innovation paradigms are used. This study is exploratory in nature. It will help to understand the impact of LLMs in higher education and facilitate further discussion in the field of AIED.

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1. Introduction

1.1. Background and Motivation

The 21st century has seen a profound transformation in educational practice, with the traditional boundaries of the classroom extending far beyond its physical walls, this evolution has been driven primarily by technological advances. Recent progress and expansion in machine learning have led to a more sophisticated technology of digital content generation like generative artificial intelligence.

The rise in popularity of ChatGPT, and other large language models (LLMs), might have the potential to start an even greater transformation within education, than COVID did in 2020 (Pokhrel & Chhetri, 2021). LLMs have an unprecedented ability to carry out remarkably complex tasks like writing an article, story, poem, or essay, providing a summary or expansion of a text, adjusting texts to reflect a different perspective, and even writing and debugging original computer code.

While some see LLMs as a promising tool for improving teaching, learning and educational research, others express skepticism and concern about the potential negative impact on traditional educational practices and perceive LLMs as a threat that may undermine critical thinking skills (Pavlik, 2023). Despite its inherent limitations, it is a nearly undeniable fact that ChatGPT and other generative AI have come to stay and will continue revolutionizing the current educational system. Due to the novelty of this technology, there is no blueprint on how to deal with these LLMs and what role they will play in the educational sector. Although AI in education has been researched for decades and has been tested out in many forms in schools and universities, the unprecedented capacities of LLMs require new research and scholarly assessment in order to properly integrate it into education.

By investigating the views and attitudes of teachers and students towards LLMs in the context of higher education, this study aims to address this research gap. Valuable insights into the potential benefits, risks and challenges of integrating LLMs into educational settings can be gained by exploring their perspectives. The results of this study will contribute to a deeper understanding of the impact of LLMs in higher education.

1.2. Objective and Problem Formulation

The primary objective of this research study is to explore the influence of Large Language Models (LLMs) on learning and teaching within the context of higher education. The main research question seeks to understand the overall influence of LLMs in the educational setting. Whereas the sub-questions aims to investigate how the role of LLMs vary depending on the academic discipline of study, explore the ways in which LLMs contribute to changes in the quality of learning and teaching and to document the prevalence and patterns of LLM usage and adoption of LLMs among professors and students in higher education.

1.3. Research Questions

To capture the influence of this new technology in the context of higher education such as universities, the following main research question has been selected:

RQ 1: How are LLMs influencing learning and teaching in higher education?

Related to this overarching question, this project also aims to answer more detailed questions, which relate to differences in disciplines, change in quality and recording current uses. Therefore the following sub-questions have been selected:

RQ 1.1: What is the current usage of LLMs by professors or students?

RQ 1.2: Does the role of LLMs change depending on the discipline of studies?

RQ 1.3: How do LLMs change the quality of learning and teaching?

1.4. Structure

The paper begins with a comprehensive literature review in Section 2, which includes definitions of LLMs, an analysis from a theoretical and higher education perspective, current usage, and opportunities and challenges. Section 2.8 explores recommendations for the integration of LLMs in higher education.

Section 3 discusses the selected theories, starting with the three paradigms of AI education, followed by an examination of the theories of social constructivism, connectivism and diffusion of innovation. These theories provide the conceptual framework discussed in section 3.5, which aims to address the research questions.

Section 4, methodology, explains the literature review process, briefly mentions the initial pilot study, and moves on to the development of the interview and survey design. The section also includes an understanding of the mixed methods approach, sampling techniques and data collection methods for both the interviews and the survey. Ethical considerations and validation processes are also discussed in this section.

Section 5 presents the analysis, starting with the results of the pilot study, followed by the findings from the interviews and subsequently the analysis from the online survey. Section 5.4 outlines the validation of the data obtained from the respondents.

Section 6 provides a discussion of the findings, using the conceptual framework to address the research questions from both the survey and interview perspectives.

Section 7 critically examines some of the limitations of the research, while Section 8 concludes the report by summarizing the key points and highlighting the implications of the study. Section 9 contains all the references in APA style while Section 10 contains all the appendices which are referenced throughout the report in various sections.

2. Literature Review

In recent years, the emergence of large language models has sparked significant interest and potential in transforming the landscape of higher education (Williamson et al., 2023). With the advancement of artificial intelligence and natural language processing, LLMs such as ChatGPT have demonstrated remarkable capabilities in understanding and generating human-like text (Qadir, 2022). This literature review delves into key dimensions such as definitions and types of LLMs, theoretical perspectives on their role in learning and teaching, educators and learners' perspectives, discipline-specific differences in LLM use, current applications in education, as well as the opportunities and benefits they offer. Overall, this section aims to provide a comprehensive understanding of the state of the art research, as well as the potential impact of LLMs in higher education. Furthermore, recommended actions will be proposed to leverage the benefits of LLMs effectively and ethically within educational settings.

2.1. Definitions and Types of LLMs

As a start for this section, we will provide an overview of the available literature related to the topic and its conception of technical definition and the applications, advantages and disadvantages of the tool that is the center of our research: the Large Language Models (LLMs).

According to Kerner (2023), a large language model (LLM) is a type of artificial intelligence (AI) algorithm that employs deep learning techniques and extensive data sets to understand, summarize, generate and predict new content. Consequently, the term generative AI is closely connected with LLMs, which are, in fact, a type of generative AI specifically designed to produce text-based content.

Following Kerner's perspective, (Zhang et al., 2020) state that while there isn't a universally accepted figure for how large the data set for training needs to be, for an optimal performance an LLM typically needs at least one billion words of pretraining data - also known as inputs or parameters. As detailed in Figure 1, the newly released GPT-4 uses around 1 trillion parameters meaning an exponential growth compared to previous versions.

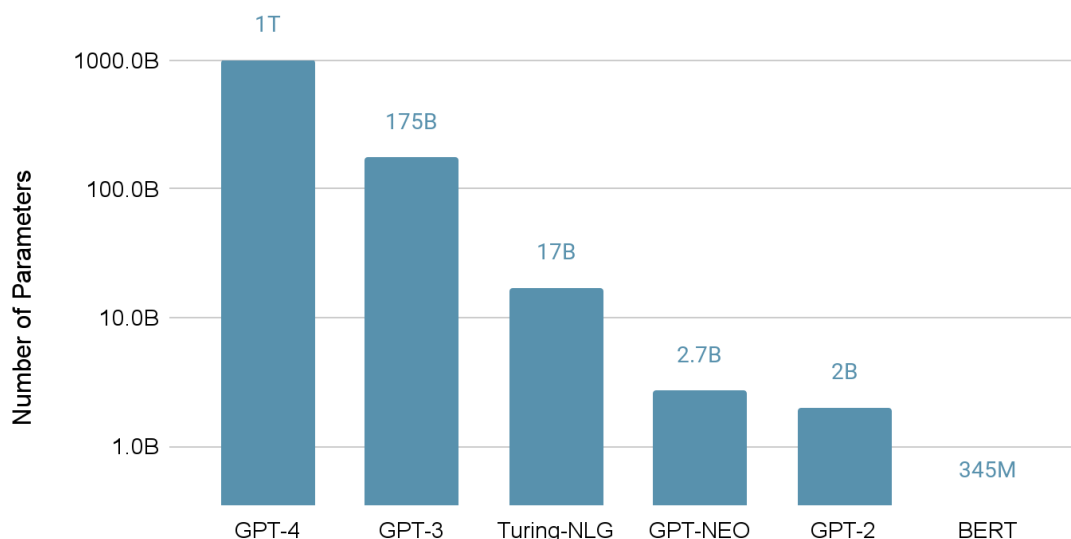


Figure 1: *Parameters of transformer-based language models*

Note. Comparison between number of parameters used by different large language models (including the newest GPT-4) to generate their outcomes.

From *What is generative AI? Everything you need to know*, by Kerner, S. M. (2023). <https://www.techtarget.com/whatis/definition/large-language-model-LLM>

According to Pavlik (2023) two major types of generative AIs can be recognized. On one hand, Generative Adversarial Network (GAN). As explained by (Goodfellow et al., 2020), GAN uses two neural networks (i.e., generator and discriminator networks) to generate outcomes. First, the generator network creates synthetic data (e.g. an image of a cat) and then the discriminator network examines the genuineness of the content to determine whether the content is authentic enough to be presented as an outcome (e.g. humans can recognize the generated cat real). Although it can be used for text generation, GAN is predominantly used for voice generation, graphics and video (Hu, 2022).

The other is Generative Pre-trained Transformer (GPT) models. GPT models are nourished from a large amount of publicly available digital content data - by using natural language processing [NLP] - to read and produce human-like text. As Pavlik (2023) states, these models can exhibit creativity in writing from a paragraph to a full research article convincingly (or near convincing) on almost any topic and are even able to engage customers in human-like conversation such as customer-service chatbots or fictional characters in video games (Aydın & Karaarslan, 2022).

As seen in the introduction of this report, LLMs have become increasingly popular. One of the main reasons is their broad applicability for a range of NLP tasks.

One of the primary use cases is text generation. LLMs have the remarkable ability to generate text on any topic they have been trained on. Furthermore, when training in different languages These models can effortlessly translate content from one language to another,

providing a valuable asset for multilingual users (Kerner, 2023). In addition, the semantic capacity of these models allows them to summarize blocks or multiple pages of text condensing information effectively and, therefore, making it easier to digest and comprehend. Related to that, LLMs also possess the capability to rewrite sections of text allowing users to modify and improve their content effortlessly. LLMs are also effective in classification and categorization. These models can analyze and organize content, helping to structure information in a meaningful way. Most LLMs can even be utilized for sentiment analysis, providing insights into the intent and emotion conveyed within a piece of content or a specific response (Lee, 2023). Finally, LLMs are particularly adept at conversational AI and chatbot applications. They facilitate more natural and engaging interactions with users, surpassing the limitations of earlier AI technologies. One notable example is ChatGPT, an LLM-based AI chatbot developed on OpenAI's GPT-3 model. Chatbots, which operate on a query-and-response model, can take various forms and serve as one of the most common applications of conversational AI (Wei et al., 2023).

In his article, Kerner (2023) also points out the multitude of benefits that LLMs offer to organizations and users. These include their extensibility and adaptability, which means that they can be customized for specific use cases with additional training. Moreover, a single LLM can be deployed across different tasks and organizations, making it incredibly flexible. Additionally, modern LLMs are known for their high performance and low-latency responses, while their accuracy increases with the number of parameters and volume of trained data. Lastly, many LLMs are trained on unlabeled data, which makes the training process quicker and easier.

Lastly, while there are many advantages to using LLMs, there are also several challenges and limitations. The first challenge is development costs. To run, LLMs generally require large quantities of expensive graphics processing unit hardware and massive data sets. Operational costs are also a challenge to consider as, after the training and development period, the cost of operating an LLM for the host organization can be very high (Nikolaiev, 2023). Along with these practical concerns, there are also other potential issues that must be considered when using LLMs. For example, one risk associated with any AI trained on unlabeled data is the possibility of bias, as it can be difficult to determine if known biases have been successfully removed. Furthermore, the explainability of LLM-generated results can be challenging, and users may struggle to understand how a particular outcome was generated (Kerner, 2023). Additionally, AI hallucination can occur when an LLM produces inaccurate responses that aren't based on its trained data, and modern LLMs with billions of parameters can be quite complex and difficult to troubleshoot when issues arise. Finally, a concerning emerging trend is the use of glitch tokens, which are prompts designed to intentionally cause an LLM to malfunction in harmful ways (Shenwai, 2023).

2.2. Theoretical Perspectives

The potential of artificial intelligence (AI) in higher education, particularly in the context of Large Language Models (LLMs), holds great promise from a theoretical standpoint. Multiple

scholars have presented their theoretical perspectives on the role of this innovative tool in the higher education context and this section will try to summarize the most relevant ones.

Artificial intelligence (AI) holds immense promise within higher education, particularly in the context of Large Language Models (LLMs). Generative AI is already revolutionizing education, instigating a significant shift in existing educational practices (Baidoo-Anu & Owusu Ansah, 2023). Specifically, AI is recognized as a powerful tool that enables new paradigms in instructional design, technological development, and educational research, which were previously unattainable in traditional educational modes (Hwang et al., 2020). And, according to Ouyang & Jiao (2021), this paradigm change specifically relies on: change to personalized learning, the challenge of the instruction role and the development of a complex educational system. Consequently, Artificial Intelligence in Education (AIEd) has become the primary research focus in the field of computers and education with the potential to transform knowledge, cognition, and culture (Hwang et al., 2020) and to offer more productive interactions with significantly less effort and minimal cost (Malik, 2016).

In the realm of education, AI has transitioned from being synonymous with computers and computer-related technologies to encompass online platforms, web-based technologies, and AI systems (Chassignol et al., 2018). According to Chassignol et al. (2018), this transition has been facilitated by changes in technology in the macro-operating environment. In agreement, Timms (2016) supports the notion that AI in education encompasses various forms, dissociating it from the sole association with computers as it includes the utilization of computer-embedded systems in smart classrooms and cobots. As a result, AI in education surpasses the conventional understanding of different technological applications, such as web-based, online, distance, and computer-assisted instruction courses and learning (Sharma et al., 2019).

Although many research papers can be found in the area of AIEd, most of this research has been done by computer scientists and have not yet been fully implemented within institutions (Bates et al., 2020). Consequently, AIEd integrates advanced computing and information processing techniques in education but it does not guarantee good educational outcomes and high quality of learning (Castañeda & Selwyn, 2018). The same idea is posed by Zawacki-Richter et al. (2019). In their study they reflect on the fact that, although artificial intelligence is in widespread use in some areas of society, in its direct impact on teaching and learning much has been promised but little has been achieved. Some authors have tried to understand the reason for this gap between AI and education. Tegmark, (2017) argues that we have yet to attain the level of Artificial General Intelligence, where the processing capabilities of machines match the cognitive capabilities of humans. While Bostrom (2014) suggests that we have endured an 'AI Winter' where AI proponents have suffered loss of credibility.

Overall, extensive literature can be found speaking about the massive impact that AI, including LLMs, can have as a game changer in higher education. However, there are very few studies that speak about the actual role of AI and LLMS in higher education and how it is

affecting education in the eyes of teachers and learners. Therefore, the goal of this study will be to comprehend and extend the existing findings – that will be presented in the next section - about the teachers and students' perspectives on the role of LLMs in higher education.

2.3. Higher education perspectives

Since the introduction of ChatGPT to the public in 2022, academics have written extensively about potential implications for teachers and students (Pavlik, 2023). Educators have begun exploring the effectiveness of LLMs by incorporating them into various educational activities, such as research, teaching, and assessment. These experiments have revealed that leveraging ChatGPT and its automation capabilities can result in time savings, enabling educators to allocate more time to crucial tasks, such as engaging with students (Alshater, 2022).

As is typical with the adoption of any new technological product, opinions regarding the implementation of LLMs in higher education are not solely positive. Some raise concerns about the use of ChatGPT within educational institutions (Herman, 2022), and in certain cases, such as in NYC Public Education, it has even been prohibited (Ropek, 2023a) due to concerns that students may employ it to automatically generate essays or complete class work. Additionally, many individuals highlight the presence of errors, often glaring (Pearl, 2022), in ChatGPT's responses, or point out instances where it demonstrates faulty reasoning when tasked with providing logical solutions, leading to contradictions in conversations (Llorens-Largo & ChatGPT, 2023).

The application of AI to Education has a lot to offer in terms of advancing towards a digital disruption of the educational system, which is perceived as close in the broader context of digital transformation of educational institutions and society (García-Peñalvo, 2021), but which has not yet occurred (Area & Adell, 2021). Therefore, opting to ignore or prohibit applications, such as ChatGPT, does not appear to be an optimal solution. Instead, a more effective approach would involve providing training to teachers and students on ethical usage and emphasizing the importance of critical thinking (Codina, 2023).

However, the adoption of AI in the field of education has been comparatively slower when compared to other sectors like finance, e-commerce, and medicine. Therefore, there is a limited number of studies examining the utilization of large language models in educational settings (Salas-Pilco et al., 2022). For example, a recent review examining the potential and challenges of chatbots in education highlighted that research in this area is still in its early stages, with a scarcity of empirical studies exploring the implementation of effective learning designs or learning strategies (Hwang & Chang, 2021). Among these limited studies, Chen et al., (2020) conducted a particularly noteworthy study with significant findings. Firstly, they assert that the utilization of AI in instructional settings or as a pedagogical tool has had a profound impact on education. It has enhanced the effectiveness, efficiency, and overall quality of instructors' work. Additionally, the authors argue that AI has played a crucial role in improving instructional effectiveness. They posit that Intelligent Tutoring Systems (ITS),

which incorporate evidence-based practices and employ cognitive and learning models extensively, have facilitated optimal comprehension and retention of materials, thereby optimizing students' learning experiences. Lastly, they contend that AI ensures the enhanced dissemination of course content, spanning from the development of the curriculum to the actual delivery of instructions, particularly within online and web-based learning platforms.

While there is a scarcity of studies specifically analyzing the use of chatbots in higher education, there is extensive research that explores teachers' perspectives on AI and Learning Analytics in education. A pilot study conducted with European teachers reveals a positive attitude towards AI in education and a strong motivation to incorporate AI-related content into their teaching practices. However, the study also indicates that the teachers involved had a basic level of digital skills but lacked proficiency in AI-related concepts (Polak et al., 2022). Similarly, a study conducted with Nigerian teachers highlights the importance of teachers' willingness and readiness to embrace AI as crucial prerequisites for integrating AI-based technologies in education (Ayanwale et al., 2022). Likewise, findings from a study involving teachers from South Korea suggest that educators with constructivist beliefs are more inclined to integrate educational AI-based tools compared to those with more traditional, transmissive orientations (Choi et al., 2023). Moreover, the acceptance and adoption of these AI-based tools by teachers are influenced by factors such as perceived usefulness, perceived ease of use, and perceived trust. These determinants should be considered when predicting teachers' acceptance of AI-based tools. Similar findings regarding teachers' attitudes towards chatbots in education were reported by Chocarro et al. (2021) perceiving the AI chatbot as easy-to-use and useful leads to greater acceptance of the chatbot. Additionally, features such as the use of formal language by a chatbot can positively influence the intention to use it.

Although it was not possible to find literature that specifically relates to LLMs, when generalizing this topic to generative AI, different classifications have been found for the roles of this technology for students.

On one hand, Hwang et al., (2020) conducted a comprehensive study that classifies the various roles of AI in education into four distinct categories based on previous literature:

- Intelligent tutor: This category encompasses a wide range of applications in the field of Artificial Intelligence in Education (AIED), including intelligent tutoring systems, adaptive/personalized learning systems, and recommendation systems. Numerous studies have demonstrated the effectiveness of intelligent tutoring systems in enhancing learning outcomes (Ma et al., 2014); (Steenbergen-Hu & Cooper, 2014); (Vanlehn, 2011).
- Intelligent tutee: Although studies in this category are relatively rare, it is worth exploring the potential of AI-based educational systems to engage learners as tutors or advisors. Encouraging learners to assist others (AI tutees) in understanding complex concepts can foster higher-order thinking skills and deepen their own knowledge.

While there have been no explicit attempts to develop intelligent tutees, many AI models and techniques are capable of learning from human interactions, which may facilitate the development of intelligent tutees in the future.

- Intelligent learning tool or partner: Taking a constructivist and student-centered approach, the provision of an intelligent learning tool or partner holds significance. Such tools can assist learners in collecting and analyzing data efficiently, allowing them to focus on critical thinking tasks such as inference and prediction, rather than mundane tasks like editing and calculation. Some tools even have the capability to analyze and present data in a "smart" manner, aiding learners in profound thinking and uncovering valuable insights within the data.
- Policy-making advisor: In recent years, AI techniques have been employed to inform and guide the development of policies and laws. Consequently, it is possible and practical to develop a policy-making advisor specifically for educational policy formulation. With the assistance of AI technologies, policymakers can gain a more precise understanding of trends and issues within educational settings from both macro and micro perspectives. This deeper understanding can help them formulate and evaluate effective educational policies (Tsai et al., 2019).

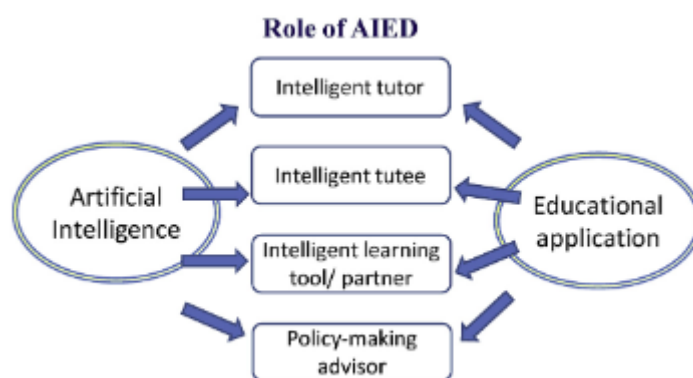


Figure 2: Roles of Artificial Intelligence in Education

Note. Framework for the roles of Artificial Intelligence in Education (AIED).

From *Vision, challenges, roles and research issues of Artificial Intelligence in Education*, by Hwang et al. (2020). *Computers & Education: Artificial Intelligence*, 1, Article 100001. <https://doi.org/10.1016/j.caeai.2020.100001>

On the other hand, Ouyang and Jiao (2021) propose three paradigms for integrating AI into education: AI-directed (learner-as-recipient), AI-supported (learner-as-collaborator) and AI-Empowered (Learner-as-Leader). The first paradigm emphasizes AI control over the learning process with little flexibility for individual learners. The second paradigm involves AI as a collaborative tool, focusing on personalized learning experiences and learner agency. The third paradigm takes a holistic approach, viewing AI as a tool to enhance human intelligence and considering the entire educational environment. Ouyang and Jiao advocate for the adoption of the third paradigm, which promotes a more student-centered, data-driven, and personalized approach to AI in education. This framework provides a useful tool for

assessing the use of AI in education and encourages a shift toward more holistic and learner-centered approaches and will be extended in the next sections as a theoretical framework for our research.

2.4. Discipline-Specific Differences in LLM Use

Although AI has its roots in computer science and engineering, it has also been shaped by a range of other disciplines, such as philosophy, cognitive science, neurology, and economics. While some academics may not fully appreciate the extent and content of AI-based educational and pedagogical resources, these tools are being integrated into higher education (Alam & Mohanty, 2023). As an example, ChatGPT has proven its extraordinary capacity to produce responses that closely resemble those of humans across a wide range of disciplines in a short time (Lim et al., 2023). Users have found ChatGPT to be helpful because it provides specific and relevant information on a wide range of subjects, including science, history, business, health, technology, and more (Tlili et al., 2023). The versatile uses of LLMs, including ChatGPT, across various fields are explored in the following based on a review of multiple articles and resources.

Journalism and media have been significantly impacted by the emergence of AI, making it an increasingly relevant topic for journalism and media education. According to researchers, AI has the potential to generate high-quality content in this field. However, generative AI tools like ChatGPT are capable of passing the Turing Test and may pose a threat to human journalists and media professionals, especially in a time of budget cuts and economic pressures. While ChatGPT is not sentient and lacks self-awareness, it excels at processing and presenting information in a human-like manner, both in written and potentially in audio or video form. As a result, AI tools like ChatGPT could be a valuable asset to assist human journalists and media professionals, enhancing the quality and efficiency of their work, particularly when faced with limited resources and time constraints (Pavlik, 2023).

In medical education, ChatGPT has the capacity to enhance learning processes by providing students with new and previously unknown concepts that are beyond their current knowledge. Overall, the impact of AI technology in clinical practice is expected to be widespread and diverse, covering all areas of healthcare (Kung et al., 2023). AI is not only valuable for medical education but is now also being tested in randomized controlled trials (Plana et al., 2022). Various observational and pragmatic studies demonstrate that AI has a versatile role in improving risk assessment (Kan et al., 2019), data reduction, clinical decision support (Vasey et al., 2022), operational efficiency, and patient communication in all medical fields and specialties (Cock et al., 2020; Kung et al., 2023).

Additionally, incorporating AI language models like ChatGPT in engineering education has the potential to be highly beneficial for both students and educators. These models can write texts and essays, answer questions, and solve homework tasks. They can be utilized for a range of purposes, including virtual teaching, language practice, generating and resolving technical and non-technical queries, and research support (Qadir, 2022).

Based on some research findings, it is also suggested that ChatGPT should be incorporated into English language programs as a means of promoting learner's motivation to learn independently, while still receiving guidance and support from their teachers (Ali et al., 2023).

Lastly, researchers anticipate that language models, such as ChatGPT, will become significant resources for practicing lawyers in the future, while also acknowledging that they may be extremely beneficial to students who use them during their law school exams (Choi et al., 2023b).

Overall, the implications of AI tools on learning, teaching, and assessment in different fields of study of higher education is a topic of ongoing discourse. An impressive example is ChatGPT-4, which has achieved remarkable success by passing graduate-level exams in various fields, including law, medicine, and business (Metz & Collins, 2023; Rudolph et al., 2023b). Nevertheless, it is crucial to acknowledge that while ChatGPT can provide support across numerous fields of study, it should not be regarded as a substitute for human teachers and educators (Khan et al., 2023).

2.5. Current Applications of LLMs in Education

The advancements made in language models represent major accomplishments in the realm of NLP and present vast opportunities for utilization in both research and industrial settings. It is expected that as NLP continues to progress, particularly in regards to large language models, these models will become even more advanced in their capabilities. This underscores the importance of exploring their potential applications in the field of education (Kasneci et al., 2023).

The use of AI technologies in education is gaining more interest every year, with an increasing number of research papers being published in this area since 2010 (Chen et al., 2020b). AI is increasingly being integrated into higher education across a wide range of applications to facilitate diverse teaching and learning approaches while improving various educational processes (Zentner, 2022).

It is worthwhile to mention that LLMs have the capability to revolutionize the methods of teaching and learning. With the development of ChatGPT, we are witnessing some of their current applications in higher education which will be explored more in the following. In general, LLMs have the potential to assist students and educators with various tasks, thereby enhancing their overall efficiency (Atlas, 2023).

2.6. Opportunities and Benefits of Using LLMs in Higher Education

In the expanding field of education technology, AI provides a chance to showcase cutting-edge tools and applications. This presents an opportunity for exciting breakthroughs in teaching and learning (Rudolph et al., 2023a). Some experts believe that AI tools, such as ChatGPT, will play a crucial role in education in the future. They also suggest leveraging technology to improve the overall learning process (Mhlanga, 2023). In the following, benefits and opportunities that LLMs provide with students and educators are listed.

2.6.1. Benefits and opportunities for students

The first benefit of using LLMs is helping students with disabilities. Large language models, along with speech-to-text or text-to-speech solutions, can be used to assist individuals with visual impairment and develop inclusive learning strategies. This technology can provide support in tasks like writing, translating, and highlighting important content. However, professionals such as speech therapists and educators are necessary to adapt the technology to the specific needs of learners with disabilities (Kasneci et al., 2023).

Secondly, LLMs can provide students with personalized learning. Personalized learning is not always feasible in society due to the limited availability of teachers and the associated costs (Bloom, 1984). By using AI models like ChatGPT, students have the opportunity to ask questions using their own words and receive customized responses that cater to their specific phrasing (Rospigliosi, 2023). This way, they will find answers to their questions, which can enhance their learning experience (Mhlanga, 2023). LLMs like ChatGPT has the capability to offer students customized tutoring and feedback, taking into account their specific learning requirements and advancements (Baidoo-Anu & Owusu Ansah, 2023).

LLMs can also aid students in research and writing tasks. Large language models are useful in enhancing students' research and writing skills, critical thinking, and problem-solving abilities (Dwivedi et al., 2023). They generate text summaries and outlines that help students understand and organize their thoughts for writing. These models also provide relevant information and resources on specific topics, as well as suggest unexplored areas and current research topics, which facilitate better analysis and understanding of the material (Kasneci et al., 2023; Rathore, 2023). Also, they are able to help students brainstorm and generate ideas (Sok & Heng, 2023).

It is worthwhile to mention that LLMs can assist students in interactive and adaptive learning too. The main idea of ChatGPT is based on posing questions and follow-up questions, which promotes the use of ChatGPT as a learning tool by engaging students in activities that are essential to interactive learning, such as asking questions and reflecting on answers (Rospigliosi, 2023). It also enables adaptive learning that can modify the difficulty of the material according to the student's proficiency and progress (Baidoo-Anu & Owusu Ansah, 2023; Opara et al., 2023). Besides, the personalized and interactive assistance offered by

generative AI adapts to users' requirements and preferences, empowering them to receive real-time feedback and make necessary adjustments. This can ultimately lead to improved performance and productivity (Luan et al., 2023).

Additionally, studies have shown that using LLMs in higher education can increase creativity. Although some researchers believe that dependence on AI tools like ChatGPT can inhibit the creative thinking of the learners (Opara et al., 2023), others think they can stimulate students' creativity to discover novel ideas and solutions to problems (Neumann et al., 2023).

The last benefit of using LLMs for students is enabling active and self-paced learning. ChatGPT facilitates self-paced learning and provides direct responses to those seeking to acquire new skills (Opara et al., 2023).

2.6.2. Benefits and opportunities for professors

Firstly, LLMs can provide professors with new innovative opportunities. There is great potential for the emergence of new or adapted teaching methods in the future. This could include a variety of changes to current methods, such as the implementation of flipped classrooms or problem-based learning. Additionally, as technology continues to develop, we can expect to see new types of exams and teaching approaches (Neumann et al., 2023).

Secondly, using new technologies can help teachers and educators in AI-assisted grading. AI tools like ChatGPT can be employed to evaluate exams and assignments, providing a more efficient and unbiased grading process (Alam & Mohanty, 2023; Karthikeyan, 2023; Neumann et al., 2023; Qadir, 2022). As a result, this automation of the assessment process will save teachers' time and reduce their workload (Zhai, 2022). ChatGPT can also provide an automatic grading system that gives students helpful feedback, which is an essential element in enhancing their educational outcomes (Sok & Heng, 2023).

In addition, educators can enhance their lesson planning through the utilization of AI tools. Large language models can aid teachers in creating inclusive lesson plans and activities by generating course syllabi, questions, prompts, and personalized practice problems and quizzes. This can help students to improve their critical thinking and problem-solving skills while also ensuring they have a solid understanding of the material (Kasneci et al., 2023).

LLMs can also help educators with student record management. With the help of AI tools, this can be made more efficient by automating tasks such as classifying, sorting, and indexing records. These technologies can assist in the organization, storage, and retrieval of student records, providing a quicker and easier means of accessing specific information. Additionally, AI can be utilized to verify and update information within these records (Zhai, 2022).

The last benefit of using LLMs for educators is improving teaching methods. Teachers can benefit from AI tools' features by creating and incorporating interactive classroom activities to enhance their pedagogical practices (Sok & Heng, 2023). They can adopt flipped learning

to prioritize critical work in class and focus on multimedia assignments or oral presentations instead of class assignments. Furthermore, they can allocate more time to provide feedback and revise students' work (Rudolph et al., 2023a).

2.7. Challenges and Risks of Using LLMs in Higher Education

LLMs have raised the most controversial and complex issues concerning the role of AI in education, including its impact on student outcomes and the ethical considerations involved (Williamson et al., 2023). The following are some potential challenges and risks to be aware of when using LLMs in higher education.

Plagiarism and copyright might be the biggest challenge while using LLMs. Language models which intend to create educational content must be trained using relevant examples of similar texts. As a result, they might use some exact texts that were in the training set while generating a new output. Since they do not mention their references, this can lead to plagiarism and copyright issues (Kasneci et al., 2023). To prevent students from plagiarizing, educators can require them to create unique assignments and conduct plagiarism checks using natural language processing and detection algorithms (Rathore, 2023). This will cause an additional burden on teachers as they will have to modify assessments and assignments (such as conducting oral exams instead of written ones), resulting in an increased workload (Neumann et al., 2023).

Over-reliance is another issue to deal with when using LLMs. Although using large language models can offer precise and pertinent information, they cannot substitute for the creativity, critical thinking, and problem-solving skills that result from human instruction (Dwivedi et al., 2023). As a matter of fact, obtaining information effortlessly can hinder these skills. This is because the model simplifies the process of obtaining answers, which can reduce users' interest in conducting their own investigations and arriving at their own conclusions or solutions. Consequently, it is essential for teachers and students to use these models as an addition to their work, not a substitute (Kasneci et al., 2023).

The fourth worthwhile risk to mention is privacy and data security. Privacy concerns are a dangerous risk of LLMs and chatbots, given that chatbots can be programmed to collect and maintain sensitive information, which may be exposed to breaches or misuse (D'Amico et al., 2023). The conversations with ChatGPT are saved, assessed, and employed to enhance the system, which could pose a serious threat to users who possess inadequate knowledge about privacy and technology (Tlili et al., 2023). There is a likelihood of unintended use of search and query data that may compromise the privacy of individuals (Halaweh, 2023). In education, it can cause concerns about the confidentiality of student information, unauthorized access to student records, and the misuse of student data for purposes that are not related to education (Kasneci et al., 2023).

Next, overcoming societal biases and discriminations emerges as an obstacle in incorporating LLMs into higher education. We cannot disregard the potential for language models like

ChatGPT to propagate societal biases and discrimination. Since these models are trained on massive amounts of data, if that data is biased, the model's output will also be biased. This can limit their utility in tasks that demand fairness and neutrality, such as employment or assessment. Additionally, they can be utilized for controlling people's thoughts and actions, or for the preservation of existing societal biases (Atlas, 2023).

Another challenge in utilizing LLMs is the absence of human emotions, intentions, and moral reasoning (Atlas, 2023). AI language models like ChatGPT do not possess emotional intelligence, empathy, or interpersonal skills that human educators have. Hence, it is challenging for ChatGPT to grasp each student's unique requirements, offer customized aid, and establish a positive and engaging learning environment (Mhlanga, 2023).

An additional obstacle lies in guaranteeing the quality of the output generated by language models. LLMs are not infallible and may generate errors or provide inaccurate responses. This can pose a limitation when utilizing them for tasks that require high levels of accuracy, such as essay grading (Atlas, 2023). Also, students may believe false or misleading information to be true without questioning their validity (Kasneci et al., 2023).

Finally, it is important to address digital division as the last risk of using LLMs in higher education. Some people may lack necessary skills or even access to the required infrastructures or an efficient Internet connectivity to use new technologies. This problem might cause a decrease in their interest and engagement and also worsen the current digital divides. Also, educators who are not familiar with AI may struggle to effectively integrate it into their classrooms (Zhai, 2022). These divisions can create a digital underclass, with certain groups being left behind due to inequalities in technology access and use (Ragnedda, 2020).

2.8. Recommended Actions

To maximize the effective use of LLMs and overcome potential challenges, it is advisable to consider some recommended actions. In the first place, implementing truly open and responsible LLMs is of utmost importance. It is necessary to take into account various factors, such as inclusivity, usability, technicalities, ethics, and appropriate usage when designing chatbots (Durall & Kapros, 2020). Following user-centered design principles and considering social, emotional, cognitive, and pedagogical aspects are crucial too (Kuhail et al., 2023). Some researchers also discuss the ethical concerns around the lack of transparency in proprietary conversational AI technologies and the need for open-source AI development. The current state-of-the-art conversational AI technologies are largely owned by a few big tech companies, making it difficult to uncover the origin of chatbots' knowledge. To counter this opacity, they suggest that universities, NGOs, governments, and tech giants should invest in independent non-profit projects to develop advanced open-source, transparent, and democratically controlled AI technologies. They also highlight the success of an academic collaboration, BigScience, which has built an open-source language model called BLOOM. They conclude that tech companies might benefit from open sourcing relevant parts of their

models to create greater community involvement, facilitate innovation and reliability, and academic publishers should ensure that LLMs have access to their full archives for accurate and comprehensive results (van Dis et al., 2023).

The second recommended action is embracing technology instead of banning. Although some institutions decided to ban AI tools like ChatGPT for their teachers and students, these tools can also bring advantages to education, such as preparing teaching materials and creating quizzes (King & ChatGPT, 2023). As a matter of fact, banning AI tools is not the solution and further discussions with experts from various domains should be established to understand and utilize chatbots for education. Future research directions could investigate the potential consequences of relying too heavily on chatbots for education. Overall, tools like ChatGPT present both good and bad sides, and policies and guidelines should be established to facilitate their adoption in schools and universities (Tlili et al., 2023).

In the third place, improving required skills is a crucial point. Some researchers suggest that students' proficiency in using chatbots has an impact on their future experiences and motivation while interacting with conversational agents (Fryer et al., 2019). To enhance learning, it is essential to consider how to obtain the most beneficial output from tools like ChatGPT. Although they do not necessitate extensive technical or Information and Communication Technology (ICT) skills, they do require strong critical thinking and questioning abilities to obtain optimal outcomes (Tlili et al., 2023). Additionally, it is essential to offer teachers sufficient resources and support to understand and use AI models efficiently. This includes providing necessary training and support to help them implement AI in their classrooms (Zhai, 2022).

Furthermore, human verification is another recommended action to consider. The use of LLMs in research requires caution, and scholars should employ expert-driven fact-checking and verification processes to avoid biases, inaccuracies, and plagiarism (Kasneci et al., 2023). Although LLMs can facilitate accurate summaries, evaluations, and reviews, high-quality journals may still require human verification or even prohibit certain applications that use this technology (van Dis et al., 2023).

Finally, new strategies should be implemented to ensure a fair assessment in educational institutions. One current key limitation of LLMs like ChatGPT is that they can only accept text as input, which poses a challenge in online examinations without effective proctoring software. To address this issue, several strategies can be considered, such as using multi-modal channels for exam questions by embedding images, experimenting with pre-recorded video questions that combine verbal questions with images, and using AI output detection by checking responses against AI language detector models. Another strategy is to return to oral exams, requiring students to demonstrate their knowledge verbally in real-time online or on-campus premises (Susnjak, 2022).

2.9. Conclusion

LLMs like ChatGPT are undeniably among the most transformative AI tools developed in recent years (Dwivedi et al., 2023). Through an exploration of various dimensions, including theoretical perspectives, students and teachers' point of views, opportunities and challenges, etc. it is evident that LLMs hold immense potential for transforming teaching and learning practices. The integration of LLMs in higher education can enhance instructional methods, facilitate personalized learning experiences, and provide access to vast amounts of information and resources (Kasneci et al., 2023).

Consequently, these AI tools have already found widespread adoption across a wide spectrum of academic disciplines (Lim et al., 2023). They are being used in writing and research tasks, personalized and interactive learning, adaptive teaching, grading, lesson planning, etc. However, it is crucial to acknowledge the ethical considerations and challenges associated with the use of LLMs, ensuring that they are implemented responsibly and with careful consideration for pedagogical goals and student well-being (Zhai, 2022). By embracing LLMs as valuable tools, higher education institutions can navigate the ever-changing educational landscape, empowering educators and learners alike to thrive in a technology-driven world (Tlili et al., 2023).

Most of the research papers examined on the newly emerging domain of LLMs have not used any theoretical frameworks. As it is to be expected on such a new innovation, the papers are rather located inside the constructivist paradigm and they work inductively. After a closer inspection, still some directions can be found. In their position paper, Ouyang and Jiao (2021) developed three paradigms for integrating AI in education, including AI-directed, AI-supported, and AI-empowered. These are underpinned by different learning theories, such as behaviorism, cognitivism, social constructivism and connectivism. Some of these theories will be explained in more detail in the next chapter, as they give a comprehensive understanding of learning and teaching.

3. Theories

This section will take a closer look at the selected theories that will be used for this research project. First, the three paradigms of AI education will be closer examined, which help classify the responses to AI in Education. As they are strongly founded in learning theories, those will be examined next. First, social constructivism will be elaborated. This theory gives a good foundation for understanding learning and teaching. As it falls short to provide a sufficient theoretical understanding for technology in education, the theory of connectivism will be elaborated and explained how it helps to describe education in the 21st century. Then, we will describe the diffusion of innovation theory, which helps to explain how new technological advancements propagate into societies. Lastly, the whole conceptual framework will be explained, which binds all of the above together.

3.1. Three Paradigms of AI Education

A very helpful way of looking at the general approach of how to integrate AI into education is provided by Ouyang and Jiao (2021). Due to its young age and the relatively few scholarly responses, it can hardly be considered a full theory. Nevertheless, this concept proves to be very useful for the assessment of this research project. In their position paper, they propose three different paradigms to systematically address the way how AI is used in education. It is important to note that, according to the authors, these paradigms are not only about how AI is implemented into education, but consider a much wider scope with aspects of pedagogy, social matters, culture and economy.

The first of the three paradigms “AI-directed, learner-as-recipient”. In this understanding, the AI directs the learner through the learning experience. This paradigm is closely connected to behaviorist learning theory of reinforcement of knowledge and stimulus response patterns and thus has the least focus on student-centered learning. The AI, or the experts behind it, have full control of the learning path and there is little or none adjustment to the learner, who will be forced to follow the predefined path designed by the AI. Criticism of this paradigm is the little flexibility to adjust towards the learners. Ouyang and Jiao voice doubts that the lack of accounting for the individual, and its characteristics and needs, might lead to a stereotype learner. In this paradigm, learners have little agency and the AI will appear like a black-box to them.

The second paradigm is called “AI-supported, learner-as-collaborator”. Here, the learner is given more agency and the AI is being used rather as an intelligent collaborator or supportive tool. The focus lies on the individual’s learning process, the interaction is more equal to the human compared to the first one. This paradigm is closer connected to social constructivism and cognitivism, as it reflects a different understanding of learning, in which learning happens through interaction with people, technology and information in socially situated contexts. Here, the learner and the AI build an active and mutual interaction for the optimization of the personalized learning experience. The AI system collects data of the learner in order to adapt towards the learner, who in turn will have the power to adjust the system for better learning. This paradigm is much more student-centered and the learner has more agency over the learning process.

The third and last paradigm is called “AI-Empowered, Learner-as-Leader”. This paradigm reflects the most holistic approach. While the first paradigms were only concerned with either the learner, or the learner in relation to the AI, this paradigm considers the whole environment of education, such as other entities like other learners, the instructor, information and technology itself. With an underpinning of connectivism and complex systems theory, this paradigm is very student-centered and the learner holds full agency over the learning process. Compared to the other paradigms, this understands AI as a tool to promote and augment human intelligence, rather than replacing it. Also, this paradigm features a much higher degree of data exchange between the learner and the AI system, through the use of e.g. human-computer-interfaces (HCI). The human stakeholders will be empowered to adapt the

AI system to their wishes, while providing them with intelligent feedback, leading to an interactive cycle of learning development.

With this framework of three paradigms in AIED, Ouyang and Jiao (2021) are providing a useful tool to assess how this new technology is being used in education. It has already been applied in plenty of studies and proves to be a useful tool (e.g. in Kim et al., 2022; Maier & Klotz, 2022). An overview of all three paradigms can be found in table 1. In their conclusion, they find that most of the current debate about AIED is happening inside the first two paradigms. But they attest that there is a development towards the third paradigm. They welcome this development and call for an integration of AI into education that is more holistic, student-centered, data-driven and personalized. Harasim (2017, pp. 133, 137) joins this call for a different use of AI. He uses a slightly different approach by differentiating between artificial intelligence (AI) and augmented human intelligence (AHI). The former is built in a way that competes with or replaces human intelligence, versus the latter, which aims to empower humans and complement human intelligence. In his book about different learning theories, Harasim also drives the discussion towards a use of AI, which augments human intelligence and is built with a maximum of human control, which is in line with Ouyang and Jiao.

Paradigm	One, <i>AI-directed, learner-as-recipient</i>	Two <i>AI-supported, learner-as-collaborator</i>	Three <i>AI-empowered, learner-as-leader</i>
<i>Theoretical basis</i>	Behaviorism	Social Constructivism, Cognitivism	Connectivism, Complex adaptive system
<i>Agency</i>	AI System or their creators	Learner	All human stakeholders
<i>Stakeholders</i>	Learner	Learner and AI System	Learners, Instructors, Information, Technology, other humans
<i>Adjustment</i>	No adjustment to learner	Personalisation to learner through data collection	Full control over AI system
<i>Implementations</i>	Intelligent Tutoring Systems (ITS)	Dialogue-based Tutoring Systems (DTS), Exploratory Learning Environments (ELEs)	Human-computer cooperation; Personalized / adaptive learning

Table 1: An overview of all three paradigms

3.2. Social Constructivism Theory

Constructivism is often not understood as a single theory, but rather as a set of theories or an umbrella-theory, which is both describing how people learn and the nature of knowledge itself (Harasim, 2017, p. 62; Mattar, 2018). It emerged in the 1970s in response to behaviorism and cognitivism and tried to account for the criticism of the “notion that humans could be programmed like robots, to always respond in the same way to a stimulus” (Harasim, 2017, p. 62) or that human minds are not made to reproduce discrete steps in order to consume and process information. Constructivism in turn states that learning is a result of mental construction that happens, when new information is added onto the individual’s existing structure of knowledge (Mattar, 2018; Pritchard, 2005, p. 17). It happens best, when we actively construct our own understanding through experience and reflection. Knowledge can be adapted and is negotiated with others (Harasim, 2017, p. 12; Pritchard, 2005, p. 32). Constructivists focus on the process of learning rather than the content of it or concrete pieces of knowledge. Learners are actively engaged and in control of the learning process and they can use many resources outside the classroom, such as their own experience, interactive materials and dialogue (Mattar, 2018; Pritchard, 2005, pp. 29, 32).

One important aspect of constructivism is metacognition, the reflection and awareness of one’s mental learning processes. Pritchard (2005, pp. 27–28, 32) argues that the reflection of your own learning behavior and patterns might lead to better learning and teachers should take this into account when developing lessons. Lai (2011) agrees to this and describes how learners should reflect on their learning in informal settings (outside educational institutions) and adapt it for the formal settings.

Other important aspects of constructivism is that the learner is actively participating and the activities are authentic. The former concept, known as active learning, encourages students to have agency about their learning process and take initiative. This is typically a student-centered way of education, without dismissing the importance of teachers (Harasim, 2017, p. 71; Pritchard, 2005, pp. 17, 32). Harasim (2017, p. 71) describes how students, guided by the teacher through the right techniques, actively construct their own knowledge, generate hypotheses and test ideas. The second concept, known as authentic learning, is concerned about how relatable the formal learning inside educational institutions is comparable to informal learning settings outside the universities and schools. Pritchard (2005, pp. 26, 32) argues that tasks, which are relatable to your own experiences and contexts make learning more likely and more holistic tasks, such as problem solving are encouraged to improve learning motivation. Lai (2011) states that both informal and formal learning should be similar in order to make it as authentic and easy as possible for learners to relate this to their life, calling it ‘blended learning’.

In the 20th century, two major approaches to constructivism have emerged and strongly shaped the understanding of its ideas and theories: Cognitive Constructivism and Social Constructivism. The latter and more influential of both goes back to the work of Lev Vygotsky (Harasim, 2017, p. 63). He developed the perspective that meaning and

understanding is growing out of social encounters. Also he noted that speech, dialogue and language are integral to thought (Harasim, 2017, p. 68). In social constructivism, the emphasis lies on the interaction of the learner with others, which is crucial for the construction of knowledge and learning. The interaction partners can be teachers or peers and they don't have to be more knowledgeable than you. Rather learning can come from many situations, social interactions, contexts and situations outside schools (Pritchard, 2005, p. 24). This dialogue is a place where ideas are considered, developed and shared, existing knowledge and schemas are referenced and new ones are developed. The exchange of thoughts will lead to learning for at least one, if not both participants and learning happens best, through collaboration and autonomous problem solving in pairs or groups (Pritchard, 2005, pp. 24–25, 33).

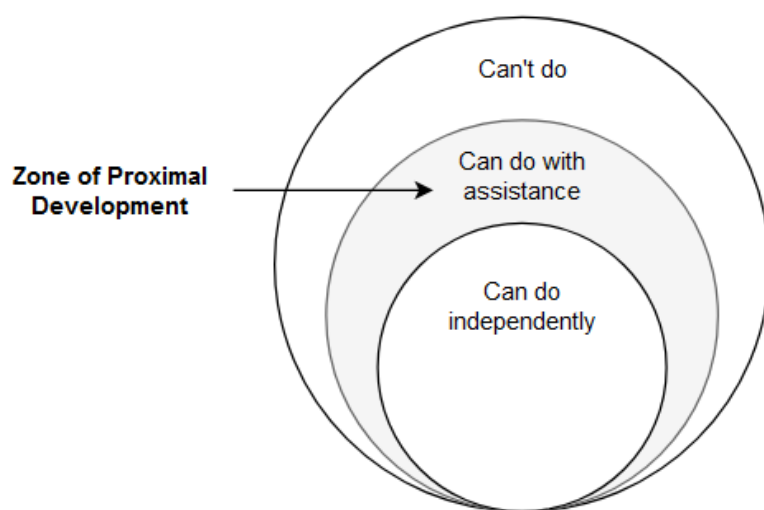


Figure 3: Vygotsky's Zone of Proximal Development

One helpful concept that Vygotsky developed is the 'Zone of Proximal Development' (ZPD). This concept describes the space of understanding, which is just above the current level of understanding of an individual. This is the space of learning which the learner will move into next, given he gets assistance or instruction (Pritchard, 2005, p. 25). Harasim (2017, pp. 69–70) describes this with the following words: "learning takes place when learners solve problems beyond their actual developmental level - but within their level of potential development - under adult guidance or in collaboration with more capable peers". Pritchard (2005, p. 25) notes that this guidance does not necessarily have to come from a teacher, it can also be from other people or materials. He goes on and describes how learners have to pass through many ZPDs in their education, doing so most effectively with guidance for this process, that takes the current level of understanding of the learners into account.

This provision of support at the right time and the right level of sophistication to pass through the ZPD in social constructivism is being called 'scaffolding'. It can happen in many different ways, e.g. through discussion, materials, the right set of tasks, the right set of keywords and so on and aims to guide the learner in the right direction and keep momentum (Pritchard,

2005, p. 25). According to Greenfield (1984, as cited in Harasim, 2017, p. 70) scaffolding fulfills five functions:

- It provides support
- It works as a tool
- It extends the range of the worker
- It allows the worker to do tasks otherwise not possible
- It is used selectively where needed.

To summarize, in constructivism and social constructivism, learning is an active, social, student-centered and metacognitive process and it is an interaction between what is known and what is to be learnt. Knowledge is constructed inside the minds of the learner and obtained, updated and reflected through social interactions. Learning can occur in any (social) setting and does not have to involve only teachers or more knowledgeable others. It works best if the learner is actively engaged and the tasks are authentic. Guiding the learners, teachers or educators should be aware of the learners level of understanding to guide them effectively through the zone of proximal development and provision the right scaffolding for the learner to master the new topic. They should focus on collaboration and social interaction, select meaningful contexts for learning and include metacognitive reflections.

Although constructivism accounts for much of the criticism of behaviorism and cognitivism, e.g. by discarding the old metaphor of ‘acquiring knowledge’ from a more knowledgeable other and shifting the focus to student-centered learning and knowledge construction, it becomes apparent that it is still a theory from the 20th century. Although constructivism has sparked the development of educational software, none of the three traditional theories of learning are able to fully provide a framework for education that has been influenced by the technology of recent decades (Harasim, 2017, p. 79). Examples of new ways of learning include Online Distance Education (ODE), personalized learning environments (PLE), e-learning, adaptive learning systems (ALS), Massive Open Online Classes (MOOC) and now Artificial Intelligence aided Education (AIEd). Boyraz and Ocak (2021) argue that new ways to produce, interact and consume information necessitate an updated learning theory. A framework, which reflects this new and strong technological influence on education and all new modes of learning that are enabled by it.

3.3. Connectivism Theory

One of the most prominent theories that have emerged out of the need for an updated understanding of education in the 21st century is ‘Connectivism’. Responding to the rapid pace of development in ICT, it was put forward by George Siemens in 2004. In his landmark paper, Siemens (2005) describes his “Learning Theory for the Digital Age” that sets its focus on network intelligence and seeks to account for learners in modern and technological structures (Downes, 2020, p. 113; Harasim, 2017, p. 81). His ideas of connectivism have been met with great response and approval, but also caused a fair share of debate and criticism. According to Boyraz and Ocak (2021) his framework is best suited for massive open online

courses (MOOC), but Downes (2020, pp. 115, 119) demonstrates how it can be applied to many educational contexts, such as the classroom. As later will be shown, connectivism still offers a helpful framework to analyze education and learning of the 21st century, which has been heavily influenced by technology.

In their conclusive literature review, Boyraz and Ocak (2021) are providing an overview of how connectivism has been understood and evolved since its inception almost two decades ago, and how it can be applied to modern educational settings. According to them, connectivism is “a form of knowledge and pedagogy that knowledge is dispersed across connections in a network and learning lies in the ability to establish and pass through these networks” (p. 1126). It accounts for the modern and technological environment of the 21st century by acknowledging the importance of networks of knowledge. The paradigm of connectivism is that knowledge is constantly evolving and decisions have to be based upon constantly changing foundations. Boyraz and Ocak (2021) and Downes (2020) describe how learning and knowing in connectivism:

- Learning takes place, when learners make connections between ideas and knowledge of their network. Knowing occurs, when the learner becomes aware of the connections between concepts and ideas.
- It is more important to have access to knowledge, rather than knowing everything yourself. Rather than “obtaining” knowledge, information should be stored in databases or other knowledge sources, which the learner can access when needed.
- Knowledge constantly evolves and the focus of connectivist learners lies on making up-to-date and flexible connections to knowledge that are relevant to the problem at hand.
- These connections need to be constantly updated and maintained to foster continuous learning.
- Learning is not just constructing knowledge, but also what information an individual can reach in their network.
- Learning and teaching is a two-sided process, where both the learner and teacher (or information source) can learn.

Similar to social constructivism, connectivism also acknowledges the importance of dialogue and social, cultural and collaborative learning. Ideally, the learner is part of a learning community with more knowledgeable others. But differently to social constructivism, it is one of the core principles of connectivism that knowledge lies outside of the learner and can be obtained from many different sources, such as wikis, databases, websites, books, etc. (Boyraz & Ocak, 2021; Downes, 2020; Siemens, 2005). In the digital age, learners are now surrounded with a plentitude of options to educate themselves and find sources of information.

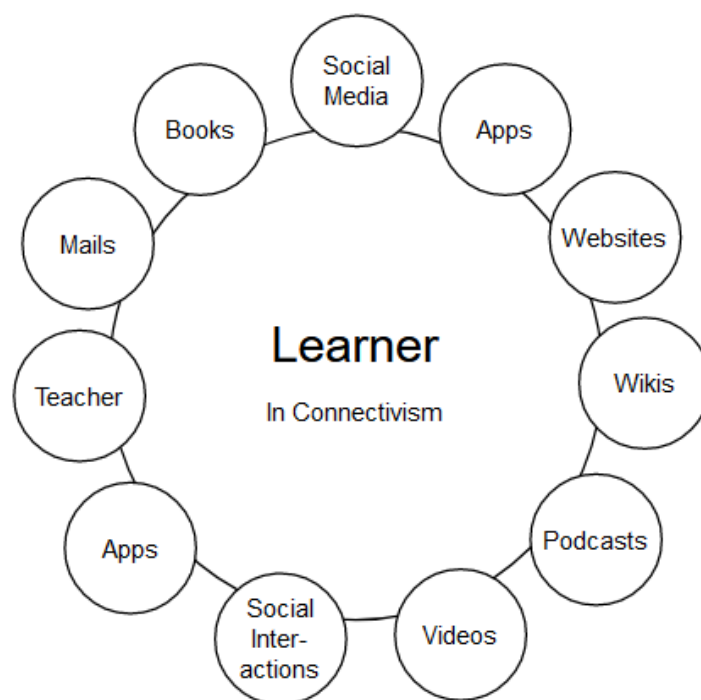


Figure 4: Sources of Information in Connectivism

What makes connectivism very interesting for the emerging topic of artificial intelligence and large language models is another of Siemens (2005) core principles: “Learning may reside in non-human appliances” (principles of connectivism section). Boyraz and Ocak (2021) elaborate on this by stating that many cognitive processes as well as problem solving can and should be left to machines. Also, machines or databases can take over the task of continuously updating the connections to knowledge. By ascribing the skill of learning to machines, connectivism distinguishes itself from the older learning theories like constructivism and adds a unique view on the use of technology for educational purposes. Connectivist learners are able to access knowledge, ‘learned’ and organized by machines, without constructing and learning it themselves.

Another interesting concept often mentioned together with connectivism is the idea of ‘lifelong learning’: the continuous process of adaptation and expansion of one’s skills and knowledge, even after the education has formally finished. Lai (2011) explains how the increasing pace of innovation and the shift to a knowledge society necessitate a new type of mind workers, who are able to adapt to constantly changing contexts. This necessitates an education system that emphasizes rather on the process of learning, than the content itself. These changed frame conditions are now putting pressure on educational institutions, who have not yet adapted to these new requirements of the evolving societies (Lai, 2011). With the rise of information sources, as well as the exacerbation of misinformation and biased content, the role of teachers shifts from the gatekeeper of information to the facilitator for the construction of knowledge (Heaven, 2023).

Connectivism has also drawn a lot of criticism over the last two decades. Boyraz and Ocak (2021) find that connectivism cannot be applied for the education of topics, which cannot be learned randomly, e.g. writing or reading. Downes (2020) found that although most students benefit from the connectivist way of learning, some students lacked autonomy and motivation and felt disconnected and unmotivated to participate. More generally, multiple scholars state that it is not actually a full theory, but rather a pedagogy (Boyraz & Ocak, 2021; Harasim, 2017) and that it can be considered as extension of other theories, e.g. social constructivism with technological pedagogy. Although many scholars raise concerns, the wide application and its new approach on technologically influenced education make it still a very suitable theory for the digital age (Boyraz & Ocak, 2021; Downes, 2020).

3.4. Diffusion of Innovation Theory

Among various theoretical frameworks, Rogers' diffusion of innovation theory (Rogers, 2010a) is the most fitting for investigating technology adoption within higher education and educational settings (Medlin, 2001). According to Rogers, diffusion refers to the process by which an innovation (technology) gradually spreads among individuals within a social system through specific channels over time. As exemplified by the case of ChatGPT, which experienced rapid and widespread adoption, attracting an impressive user base of 1 million within a concise timeframe (Sier, 2022).

One of the main concepts that helps analyze this research project is Rogers' five categories of adopters. Rogers (2010a) acknowledges that these are ideal types, which will have exceptions, but nonetheless enable good comparisons. First, there are the Innovators. They have a good social network with other innovators, financial resources, technical knowledge and are able to cope with uncertainty. They tend to accept risks and play a gatekeeping role in their social circle with regards to innovations. With around 2.5%, they are the smallest group in Rogers' framework. Next will come the early adopters. They are more integrated into local social systems and have roles of opinion leadership. They often serve as a role model for other members of the social system. They constitute 13.5% of a group. Next will come the early majority, which adopts new ideas just before the average member of a society. They rarely hold positions of opinion leadership and are the one of the biggest groups with 34%. With a similar size, the next group will be the late majority. This rather skeptical group adopts new innovations rather because of economic necessity and they will only adopt, after most others have done so. Lastly, the laggards are at the end of the spectrum. They are the most local and isolated group of people and they tend to have traditional views that rather connect with the past. They look at innovators with suspicion and resistance. With 16% they are the third biggest category. An overview of these categories can be found in figure 5.

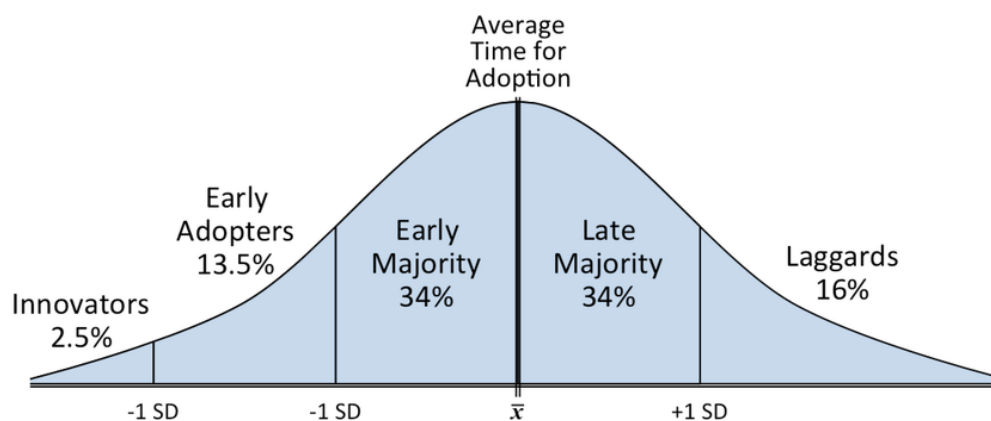


Figure 5: Rogers' five types of adoption (Dearing & Cox, 2018)

Also, Roger's theory encompasses four key components: innovation, communication channels, time, and the social system. Innovation, as defined by Rogers (2003, p. 12), refers to an idea, practice, or project that is perceived as new by an individual or a group adopting it. It's important to note that an innovation may have been developed long ago, such as the GPT family of text-generating AIs, but if individuals perceive a specific iteration, like ChatGPT, as new, it can still be considered an innovation for them (Haque et al., 2022). According to Rogers (2003, p.5), communication involves the exchange of information among participants with the aim of achieving mutual understanding. This process relies on channels through which messages are transmitted from sources to receivers. Rogers defines a source as an individual or institution that initiates a message, while a channel represents the medium through which the message is conveyed from the source to the receiver (p. 204). Within Rogers' theory, time plays a crucial role in the diffusion process as it encompasses the categorization of adopters and the rate of adoptions. Additionally, the social system exerts influence on individuals' inclination towards innovativeness (Dearing & Cox, 2018). It has been argued that innovations that offer greater relative advantage, compatibility, simplicity, trialability, and observability are more likely to be adopted at a faster rate compared to other innovations (Davis, 1985; Moore & Benbasat, 1991; Rogers, 2010a).

To summarize, Rogers' diffusion of innovation theory has the right concepts that are needed to assess how innovation spreads in societies and who plays which role in this.

3.5. Conceptual Framework

This section will explain the conceptual framework used for this research project. The framework combines the previously described theories and outcomes from the literature review into a conclusive system that helps to analyze and answer the research questions. As this research project is concerned about the influence of technology on education, theoretical perspectives on both education and technology are needed. An important aspect of the framework will be the three paradigms of AI Education by Ouyang and Jiao (2021). It helps to understand and classify the different reactions and understandings of people and experts who discuss and shape the integration of AI in education. All of the three paradigms are strongly underpinned in learning theories and relate to different understanding of education.

Therefore learning theories should also be considered for the framework. As paradigm two and three revolve around the learning theories of social constructivism and connectivism, these are selected as part of this conceptual framework. They will provide a general basis of education in the 21st century, as well as a deeper understanding about learning and teaching and how knowledge is created. Lastly the theory of diffusion of innovation will be used to provide a structured way of understanding how technology diffuses into society. This will provide the right tool to contextualize the findings of the survey and the interview. Figure 6 provides an overview of this framework. The rest of this section will be used to explain how each theory or concept will be used inside this research project.

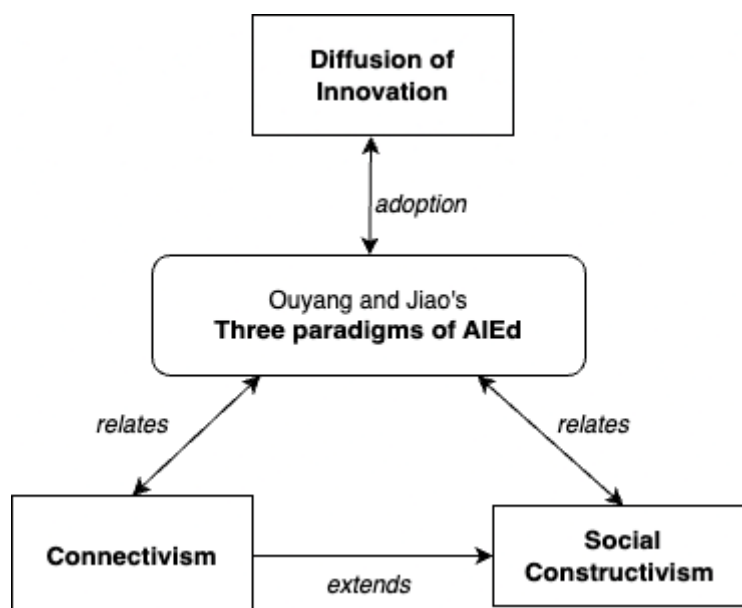


Figure 6: Overview of Conceptual Framework

The recent and sudden release of ChatGPT onto the world has sparked fierce debates, emotional reactions and very different opinions. As seen in the literature review of this research project, also in the context of education, there have been many strong and very diverging reactions to this technology. The three paradigms in AI Education by Ouyang and Jiao (2021), as described in more detail in section 3.1, are very helpful in classifying and understanding these responses. By emphasizing and classifying the different paradigms and their theoretical underpinnings into three distinct categories, Ouyang and Jiao create a tool that helps understand the debate around AI in Education and see the different strands of argumentation more clearly. The framework shows that the general learning paradigms of behaviorism, constructivism and the more holistic approaches of connectivism and complex adaptive systems are reproducing in the debate of AIEd. This will provide helpful insights for the analysis of the data generated by this research project.

Although the three paradigms are very helpful and concise, the close connections to learning theories require a thorough inspection of them. Social Constructivism and its very comprehensive view on education will help to understand the basics of learning, teaching and knowledge and give the right framework to analyze the results of the study. It is important to

acknowledge that older, teacher-centered learning theories, where individuals consume discrete chunks of knowledge for reproducible behavior and outcomes, are not suitable anymore to describe the learning process of humans. Rather learning is a personal, active and social process and knowledge is constructed inside each individual's mind and related to existing concepts and structures. Ideas will be negotiated and agreed upon in a group with peers and more knowledgeable others. Learners learn best, when they are actively engaged, have authentic learning environments, are in charge of their learning process and employ metacognitive processes like reflecting one's learning behavior. It is also worth noting that learning can come from many contexts, materials and situations outside the school, especially from social interactions. This general and up-to-date understanding of education will be the right starting point to understand the data generated by the survey and the interviews.

Vygotsky's concept of the zone of proximal development (ZPD) as well as the related process of 'scaffolding' are very suitable concepts to explain teaching in a student-centered learning environment. During the course of their education, learners have to pass through the ZPD many times. According to this concept, learning happens best, when teachers are aware of the student's level of understanding in order to provide just the right amount of support at the right time (scaffolding).

The relevance of this concept increases with regards to the use of LLMs in education. ChatGPT and the like are able to adjust learning material for many different levels of understanding, languages and learning styles, thus offering teachers the ability to efficiently generate content for each student's current level of understanding. This enables every teacher to tailor the material for each individual and provide the right level of scaffolding for the new knowledge to be acquired. Also the emphasis of metacognition and authentic learning gain relevance with LLMs. These models have the ability to automatically relate the tasks or given material to real-world problems and engage the learners in metacognitive processes, thus improving the learning experience.

According to social constructivism, speech, dialogue and language are integral to thought and understanding is growing out of social encounters. The interaction with others (peers or more knowledgeable others) is important for the construction of knowledge, often leading to learning in both or all parties involved. This social view on learning is very interesting, when considering technologies like ChatGPT. LLMs practically constitute a social partner to converse with. This enables a technological tool, available to everyone at all times, to have dialogues like with a peer, getting feedback from the perspective of a teacher, or provoking counter arguments to the learners standpoint and much more. LLMs have great potential to augment and improve social constructivist learning.

Constructivism helps to gain a general understanding of learning, teaching and the nature of knowledge, but lacks the perspective on how technology affects education. This is especially the case regarding the increased changes in ICT over the recent decades. To account for this, the theory of connectivism, which can be considered as an extension to social constructivism, is being used. Connectivism provides a very good lens to analyze the influence of modern

ICT on education and prove very insightful when inspecting the influence of LLMs specifically. Next to the teacher, websites, books and wikis, LLMs will become a very powerful new source of information in the network of the learner. Tools like ChatGPT can be used in formal and non-formal settings to gain access to knowledge. Arguably more importantly, they can be used to point in the right direction to other sources of information, such as papers, books or websites. This way, LLMs have the potential to act as an intelligent gateway and source to information simultaneously, thus greatly increasing the reach of a learners network of information.

One of the base principles of connectivism states that learning may happen inside non-human agents, such as machines. LLMs embody this principle probably like no other technology, as their ability to aggregate and synthesize knowledge is unparalleled. Although these technologies tend to make up knowledge (hallucination) or represent issues in an unbalanced way (bias), they can be considered very useful for the learning purpose. This is especially relevant, as one of the paradigms of connectivism is that “knowledge is constantly evolving”. Thus, the task of learners is to constantly keep updating the connections to current knowledge. LLMs that are able to access various sources of information, such as the internet, can greatly benefit learners by taking over the resource-intensive part of learning, so just the right amount of information can be presented to the learner. If done right, learners can leverage tools like ChatGPT to engage in scaffolding themselves. This ‘learning’, that now happens by LLMs and is available to learners as a new node in their network, can greatly benefit the connectivist learning process of making connections between concepts and ideas.

Lastly, the emergence of large language models might affect the concept of lifelong learning and the changing role of teachers. On the one hand, LLMs offer more accessible ways than ever to access knowledge about an unknown topic, thus engaging in independent learning outside of educational systems. On the other hand, the new capabilities of generative artificial intelligence cast a new light on the credibility of texts, pictures and other sources of knowledge. Hallucinations in the texts and biases in the datasets result in myriads of questionable content that need to be consumed carefully and critically. This might necessitate an educational system, which rather focuses on the process of learning than on the content and shifts the role of the teacher from the gatekeeper of knowledge to the facilitator.

The theory of diffusion of innovation is used as a binding link between the educational and the technological perspective. It provides concepts to analyze how innovations are diffused. Using Rogers’ five categories of adopters will shed an insightful light on the results of the survey and the interviews, as it might be able to explain different behavior of different groups of people. In total, this can be used to understand how LLMs such as ChatGPT propagate into the circles of education, such as universities, teachers and students.

To conclude, social constructivism and connectivism create a comprehensive theoretical perspective to analyze the matters of learning in the 21st century. The outcomes of the literature review provide helpful concepts concerning LLMs and AI in education. Lastly,

diffusion of innovation will help to explain how this new technology is disseminated into the circles of education.

4. Methodology

This chapter will explain the methodological steps taken by this research project. First, the literature review process will be elaborated. It led to an exploratory pilot study, which will be explained afterwards. As the research questions are concerned about both students' and professors' views on the subject, a mixed-methods research approach was utilized for the further research endeavor. This is partly to account for the difficulty to generate generalizable data for professors, as well as to add a constructive and inductive component to this research. The following section concentrates on aspects such as sampling, the design of interview and survey questions, as well as data collection. Finally, the chapter concludes with a discussion on data analysis, ethical considerations, and validation.

4.1. Literature Review

This section provides an overview of the process of the literature review, which formed the fundamental basis of the study. A systematic and rigorous approach was taken to the collection of academic material. A variety of related keywords were used, which can be found in table 2.

Keywords
<i>AIEd</i>
<i>Educational Technologies</i>
<i>ChatGPT</i>
<i>LLMs and Higher Education</i>
<i>Chatbots</i>

Table 2: Keywords used for the literature review

These selected keywords served as the first stepping stones in the research, allowing for the identification of key papers and seminal works in the field. In an attempt to broaden and enrich understanding, a multifaceted approach was adopted by delving into the references of the identified papers. This proved invaluable in providing additional insight and guiding us to find more relevant literature. Through the iterative process of search, review, and refinement of the search strategy, the research took on a dynamic and constantly evolving nature. This iterative cycle (refer to figure A1) ensured that the most relevant, up-to-date and comprehensive research available in the field got included.

This systematic and comprehensive approach assured that the literature review would generate an up-to-date understanding of the research in this domain. Contributing to the

overall validity and credibility of the research, the findings and insights derived from this comprehensive review provide a sound basis for subsequent analysis.

4.2. Pilot Study

As the topic of LLMs in education is very young and just emerging, this research project is mostly inductive in nature. In order to guide this open process, it became apparent that a pilot study would benefit the initial phase of the research and provide first guidance. According to Beebe (2007), pilot studies are essential for identifying design flaws, developing data collection and analysis plans, and gaining participant experience. In order to ensure the effectiveness of the main research, the importance of this approach was recognized and put into practice. For this, three professors with different levels of expertise and two students have been selected based on a purposive sampling method. The un-structured interviews with these five participants were conducted in an online meeting format and the topic of LLMs in education was freely explored. The results of the pre-study guided the further research process and shaped the following steps.

4.3. Mixed Methods

The research questions ask for the perspective of both the students and the professors of higher education. To get the most extensive insights into the situation, it has been decided to work quantitatively and qualitatively within a mixed method approach. This allows us to inductively generate data and emerging themes of in-depth interviews, while also working more deductively and generating generalizable data with a survey. Due to the nature of the environment of higher education, it made sense to select the comparatively scarce professors with more experience as the participants for the interviews, while selecting the numerous students as participants for the survey.

Thus, one phase involves sampling of students (quantitative), and another phase involves sampling of professors (qualitative), which form a multi level relationship (Onwuegbuzie & Collins, 2007). By complementing one another, the combination of quantitative and qualitative methodologies provides more comprehensive research, leading to a more in-depth understanding of the complexities and trends associated with the problem being studied (Greene et al., 1989; Tashakkori & Teddlie, 2010). According to Figure A2, the research was conducted using a concurrent timing approach with equal weighting given to both qualitative and quantitative data. The results from both methods will be merged during interpretation. Although it is important to acknowledge that mixed methods studies can present challenges due to the additional workload, financial resources, and time required (Molina-Azorin, 2016), this research involved five researchers who were able to leverage their diverse skill sets across both the quantitative and qualitative domains, ultimately enhancing the quality of the study's findings.

4.4. Development of Interviews and Survey Questions

The process of formulating questions for interviews and surveys involved categorizing them into three distinct areas: usage, role, and quality. Within each category, specific sub questions were developed to explore topics such as the current utilization of LLMs by students and professors, disciplinary variations and the impact on quality of learning and teaching.

4.4.1. Interview Design

To guide the development of qualitative interview questions, we relied on the conceptual framework and findings from the literature review. This approach facilitated a deeper understanding of how LLMs would influence education, both presently and in the future, through the insights and perspectives of professors. Thus table 3 illustrates how each interview question relates to the research questions.

<u>Sections</u>	<u>Interview Questions</u>	<u>Research Question</u>
Background	1. Could you briefly introduce yourself, your experience and courses you teach?	<ul style="list-style-type: none"> • General
Usage	2. Have you used ChatGPT before? If yes, how? If no, why not? 3. Have you encouraged your students to use ChatGPT? If yes, how? If no, why not?	<ul style="list-style-type: none"> • Main RQ • RQ 1.1
Role	4. What is your current perception of the role of ChatGPT in higher education? Why? 5. Where do you see the future role of ChatGPT (and other LLMs) in higher education? a. Follow up: Why? How do you see it for learning and teaching? 6. What role(s) does ChatGPT play in your discipline of study? a. If expert: Do you believe that ChatGPT plays different roles based on the discipline of study? 7. What role(s) does ChatGPT play in your method of teaching?	<ul style="list-style-type: none"> • Main RQ • RQ 1.2
Quality	8. Does ChatGPT already affect the quality of learning and teaching? How? 9. How do you expect ChatGPT will affect the quality of learning and teaching in the future?	<ul style="list-style-type: none"> • Main RQ • RQ 1.3
Concluding Remarks	10. Is there anything else you would like to add or discuss before we conclude the interview?	<ul style="list-style-type: none"> • General

Table 3: Interview Questions

4.4.2. Survey Design

When designing the survey, the goal was to come back to the roots of the study and be able to define survey questions that can solve our main research questions. For that, we defined 12 questions that we can divide into 4 sections:

<u>Sections</u>	<u>Survey Questions</u>	<u>Research Question</u>
Knowledge and usage	<ol style="list-style-type: none"> 1. How is your knowledge regarding ChatGPT(or similar tools) ? 2. How often do you use ChatGPT(or similar tools) in your studies? 3. What are the reasons preventing you from using ChatGPT (or similar tools) in your studies? 4. For which purposes do you use ChatGPT (or similar tools) in your studies? 5. How comfortable are you with adopting ChatGPT (or similar tools) as a new technology in your studies? 	<ul style="list-style-type: none"> • Main RQ • RQ 1.1
Quality of Learning	<ol style="list-style-type: none"> 6. How has using ChatGPT (or similar tools) affected the quality of your learning? 7. What is the teaching method in your university? 	<ul style="list-style-type: none"> • Main RQ • RQ 1.3
Role	<ol style="list-style-type: none"> 8. What roles does ChatGPT (or similar tool) fulfill for you in your studies? 	<ul style="list-style-type: none"> • Main RQ
Demographic	<ol style="list-style-type: none"> 9. How do you identify yourself? 10. What is your discipline of study? 11. What country are you studying in? 12. How old are you? 	<ul style="list-style-type: none"> • RQ 1.2 • General

Table 4: Survey Questions

4.4.3. Structure of the Survey Questions

Besides that, each question and its possible answers was defined using the framework generated from the theories and literature review (see appendix B). The order and logic of the survey questions are as shown in the below diagram.

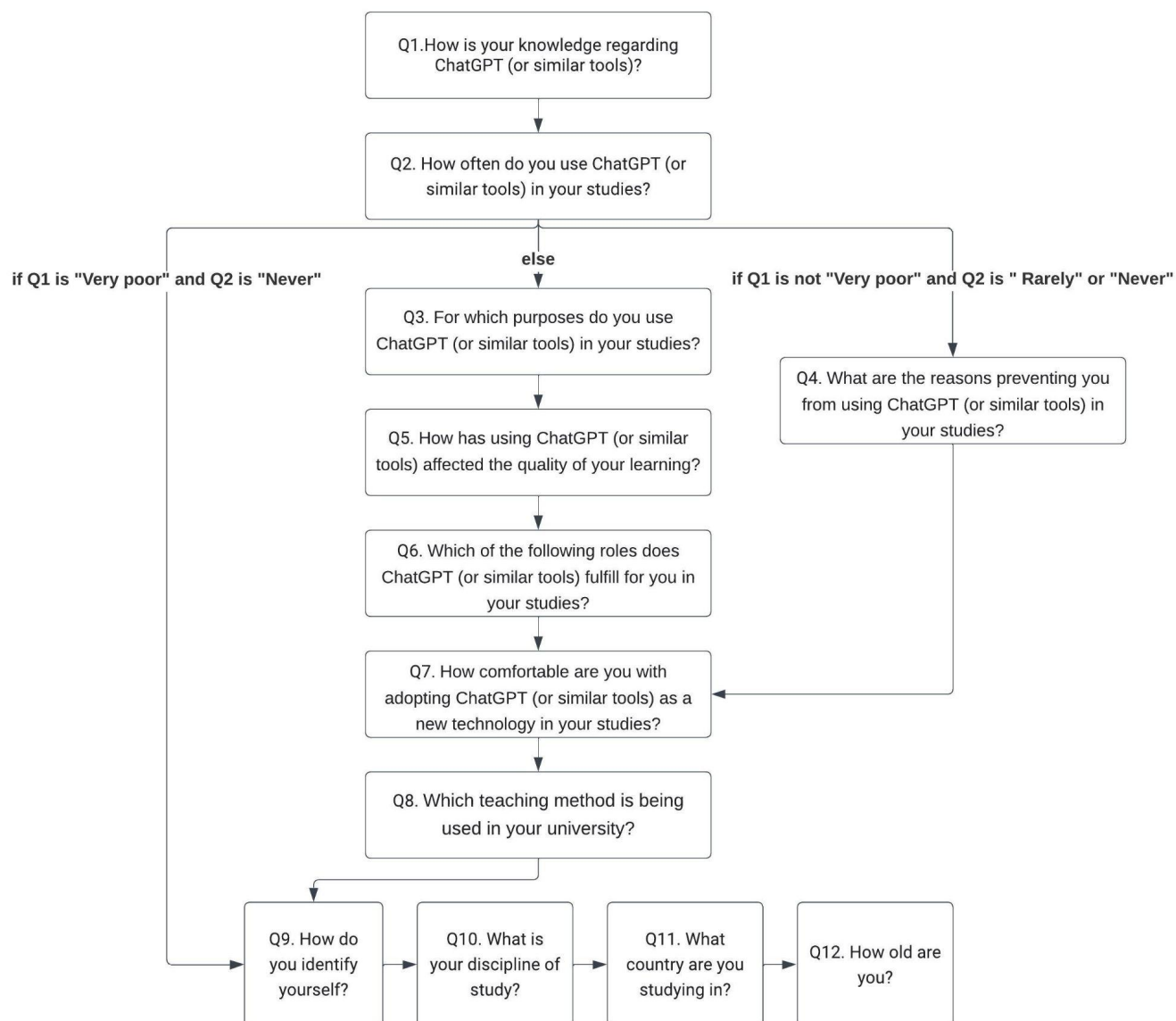


Figure 7: Flowchart of the Survey Questionnaire

In order to promote an optimal quality of the survey results, this structure was created. First of all, the more general and broad questions were placed at the beginning. Depending on their results, the different flows for the more specific questions were defined. As it can be seen in Figure 7, the students with a very low level of knowledge and a non-existent use have been redirected to the end of the survey, as they will not have the capacity to provide any insights on ChatGPT (or similar tools). On the other hand, students with knowledge but little or no usage were redirected to a flow where they avoided questions requiring some usage and were asked for reasons for non-use. The remaining students followed a natural flow that included questions related to purpose and quality of learning.

4.5. Sampling

The research employs the occasional combination sampling method, which is depicted in Figure A3, as it is widely utilized as the second most prevalent sampling technique (Onwuegbuzie & Collins, 2007).

4.5.1. Qualitative sample

Non-probability sampling was used in the qualitative research phase of this study to select participants. The study contacted professors from various fields, such as social sciences, artificial intelligence, curriculum, pedagogy, education, human-computer interaction, political science, entrepreneurship, law and medicine, from different geographical locations around the world, who had familiarity with ChatGPT and other LLMs to ensure that data about various disciplines is collected to answer the sub research questions.

Keeping an estimate of five interviews as the cutoff point will allow us to gain more insightful data. A total of 25 academics were contacted while keeping the threshold in mind, and 7 of them answered and agreed to the interview. Based on the information received, the researchers decided to conduct 7 interviews lasting 20–32 minutes in order to gain a deeper understanding of the instructors' perspectives as professors of medicine and law were unable to respond.

4.5.2. Quantitative sample

To ensure a representative sample of students, the quantitative research employed probability sampling techniques and the online survey was distributed among students across the globe using the snowball sampling method. The chosen method was convenient for reaching out to students across different academic disciplines, studies, universities and countries that results in a large but also diverse sample. For the sample, a minimum of 150 responders was anticipated. However, throughout the two weeks that the data was collected, we received 207 replies, above the 150 responses that were set as the sample criterion. Further detailing on the characteristics of the sample will be provided in the analysis of results section as it was a result of the survey.

4.6. Data Collection

4.6.1. Interviews

For data collection in the qualitative phase, we conducted semi-structured interviews with 7 professors from various disciplines. This method was chosen because it allowed for flexibility in asking follow-up questions and identifying new themes that may have been overlooked with a predetermined set of questions. The interviews initially followed a structured set of questions, but additional non-preplanned questions were introduced as appropriate.

The duration of each interview ranged from 20-30 minutes, and they were conducted online and recorded using screen video/audio recording software with the participants' consent. Prior

to the interview, participants were provided with an interview guide (refer to appendix C) and consent form to review and sign. All recordings and notes were kept confidential and secure.

4.6.2. Surveys

To collect data in the quantitative phase, an online survey with self-administered questionnaires was chosen as it is a more time-efficient method than conducting individual interviews with students from diverse backgrounds. The online survey is cost-effective and can be easily shared through snowball sampling to reach a larger audience. The survey used partially closed-ended questions with a five-point Likert scale to provide a quick and easy response format for participants. Some open-ended questions were also included in the survey to allow respondents to provide their own answers, although closed-ended questions were primarily used to simplify data collection and analysis.

The tool used to design the survey was Google Docs and we used messaging applications and social network groups as channels for the survey distribution. The timeline for data collection was 2 weeks during which we obtained 207 responses that surpassed the 150 responses expectations fixed as a sample requirement.

4.7. Data Analysis

4.7.1. Interviews

We utilized theoretical thematic analysis on the transcribed interviews for the qualitative phase of our data analysis to identify patterns (Braun & Clarke, 2006) within the data. This approach was selected after recognizing relevant themes during our literature review and pilot study and provided valuable insight into participants' (professors) perceptions and views on LLMs, including ChatGPT in education. With the help of a computer-assisted qualitative data analysis tool, we coded the transcribed interview notes, resulting in 10 themes that were used to understand participants' perceptions. We also identified complementary or new themes during transcription. To ensure accuracy, interviews, transcription, and thematic analysis were conducted in pairs, with one interviewer coding each interview.

4.7.2. Surveys

The analysis of the survey data involved a comprehensive set of procedures to ensure the accuracy and meaningfulness of the results. Initially, the non-numeric data collected from the survey responses were converted into a Likert scale, which allowed for a more understandable representation of the data. These Likert scale responses were then cross-tabulated based on the specific subsections of the research, providing a structured view of the relationships within the data. In order to maintain the integrity of the data, a meticulous data cleaning process was undertaken to identify and remove any inaccurate or missing responses.

Additionally, beyond descriptive analysis, further statistical analysis techniques were employed using software tools such as Google Sheets to uncover deeper insights and patterns in the data as we did not have enough experience in more advanced software such as R. This

comprehensive approach to survey analysis ensured the robustness of the findings and facilitated the interpretation of the collected data. To optimally visualize our data, pie charts were used to display data for proportional insights and dispersion charts were used to display correlational insight between variables extracted from the sample data.

As there were different survey flows depending on the student's answers, for Q3, Q4, Q5, Q6, Q7 and Q8, data cleansing was made to avoid blank answers and therefore the number of data from students for these questions was less than 207.

Lastly, it is important to mention that for some questions, students had the chance to submit their own answers under the option "Other" in addition to the predefined options. The analysis of these answers was managed in three different ways:

- The data was categorized as "Other" in the analysis.
- The data was refined into predefined groups.
- The data was categorized in new answer groups

4.8. Ethical Consideration

Ethical considerations were given utmost importance to prioritize the welfare and protection of participants during the qualitative phase of the study. Prior to recording any interactions, participants were provided the freedom to give their consent or refusal to be recorded. It was explicitly stated that participants had the right to withdraw at any time without facing any negative consequences. To safeguard privacy and confidentiality, proactive measures were taken to anonymize the data by minimizing the inclusion of personal information. Participants were provided with comprehensive and transparent information regarding the goals of the study and their role in it. They were also given the option to request access to the final report if they expressed an interest in reviewing it. The study methodology was explained in detail to facilitate participants' understanding to enable them to be well-informed and able to make informed decisions about their participation. Ethical considerations were also upheld during the quantitative phase of the study. Participants were fully informed about the scope and purpose of the research during the survey, ensuring transparency and fostering an ethical research environment. Importantly, no personal data was collected during the study, thereby further safeguarding participants' privacy and confidentiality.

4.9. Validation

Validation of the results of the survey and interviews was essential to the establishment of credibility of the research. Therefore, all seven professors interviewed were contacted by email to read the research findings and provide some feedback on the nature of the themes emerging from the data. There was one response and their feedback was part of the validation part of the findings.

5. Analysis

5.1. Pilot Study

Professors in pilot study highlighted the benefits of ChatGPT, including increased accessibility and participation in the classroom. However they also shared concerns about the risk of technology disengaging and distracting learners. The students were equally enthusiastic about using ChatGPT in their classrooms, enabling them to personalize their learning according to their needs. These initial findings suggest that technology can be a beneficial tool in higher education but that careful design and implementation are needed to maximize the benefits of technology while minimizing the drawbacks. As a result, a number of themes (refer to table 5) emerged that shed light on key aspects related to the area of research.

<u>Themes</u>	
AI Literacy	Ethical Considerations
Bias	Prompt Engineering
Equity	Self-directed Learning

Table 5: Themes from the Pilot Study

5.2. Interviews

The study incorporates interviews with seven professors from different disciplines and countries (for more details, check Table C1), aiming to obtain a comprehensive and varied range of insights for the research. We used following codes to label different parts of the interviews which were later used for thematic analysis to identify following themes:

5.2.1. Themes and Codes

#	Theme	Codes
1	Current Usage and Use Cases	Text Generation Text Analysis Text Summarizing Research Assistant
2	Effects on Quality of Learning and Teaching	Improve Decline Human Touch
3	Discipline specific Effects	Discipline

4	Teacher-Student Interaction and Methods of Teaching	Classroom Teacher-Student Ratio Personalization
5	Assignments, Assessments and Grading	Assignment Assessment Grading
6	Academic Integrity and Ethical Issues	Plagiarism Copy-Paste Bias
7	AI Awareness and AI Literacy	Prompt Engineering Teach teachers AI Awareness
8	Guidelines, Policies and Challenges for Integration	AI Ethics Guidelines Ban
9	AI Divide, Inequity and Inclusion Challenges	Inequity AI Divide
10	Nature of Disruption and Future Possibilities	Disruptor

Table 7: Themes and codes

5.2.2. Current Usage and Use Cases

This theme covers the interview questions focusing on how ChatGPT is being used by the interviewees [professors] and their students in various academic settings and scenarios. Using four codes—**Text Generation**, **Text Analysis**, **Text Summarizing**, **Research Assistant**—we identified numerous use cases where academics employed ChatGPT for a variety of purposes.

For the classroom, professors are using it to generate text for discussions, sample questions and lectures. ChatGPT helped in brainstorming and generating ideas as a starting point for further discussions

“Students can ask AI based technology to make short versions of texts of longer texts, so we can have a discussion or we can have more texts to be prepared for our lectures” - Interviewee #1

“In my teaching I’ve been using it to help with prompt generation for thinking about discussion forums, sample questions for students to work on. My courses don’t have exams [...] but it’s more for formative reflection on what you’re learning and whether or not you’re learning. So it’s been really helpful for generating those.” - Interviewee #2

"I've also encouraged students to use it as a starting point for their work. [...] I also said, you can use the ChatGPT as a starting point for creating your assessments. So you can enter in a prompt. we explored several different prompts that you could enter in order for them to create a basic starting place for it." - Interviewee #3

ChatGPT is playing role of a Research Assistant for some professors who are using it to assist in various tasks including literature review, data analysis, summarizing topics and preparing training decks:

"I was using it for literature reviews. I asked my students to do literature reviews themselves and asked ChatGPT to do literature reviews, and then we compared those. This was one application where we used ChatGPT " - Interviewee #1

"We're using this in research as well. I'm doing a large study on data use in the [Province Name] and so one of my RA's [Research Assistant] is particularly good at using AI tools so we're writing a methods paper on using AI to help qualitatively analyze our data or to analyze our qualitative data" - Interviewee #3

"I have queries and I'm trying to address those, so I asked ChatGPT to give me a summary of various things, and that saved a lot of time on my end." - Interviewee #5

"I'm training staff and faculty on it. So for the staff I'm using it to teach them how to write prompts for emails, for example, and I'm using ChatGPT to make the training decks". - Interviewee #2

As a research assistant, one specific use case is writing research paper where one professor used ChatGPT to check for errors, generalization and bias:

"If I'm writing a research paper, for example, I write a paragraph then I copy-paste the paragraph in ChatGPT and ask ChatGPT to tell me if it is okay? If there are any conceptual errors in that, [...] or if I'm not being biased, or if I'm not generalizing something, then ChatGPT is able to give me a very unbiased not always unbiased, but there's some time it is quite an accurate identification of some problem that exists in what I'm writing." - Interviewee #5

Another example for writing paper was the use of ChatGPT for taking feedback to correct the tone and paraphrasing to avoid overgeneralization:

"Recently I wrote a paper where I checked every paragraph for every section by taking feedback from ChatGPT and it gave me pointers where I can actually make corrections, and it also often rephrase the paragraphs for me if I was trying to generalize something over generalize something that it kind of change the tone of the argument to make make it sound more unbiased. So it is helping me in that context" - Interviewee #5

One professor mentioned the importance of ChatGPT as a translator at their university because of diverse background of their students:

“The majority of my students speak more than two to three languages, English being one of them. So thinking of ChatGPT as a translation tool is crucial at [University Name]” - Interviewee #2

Another professor used ChatGPT as an alternative to Google because of ChatGPT’s ability to understand sophisticated queries and generate a summarized output unlike google where user has to go through the output of search query:

“Using it almost on a daily basis, instead of Google I’m rather using ChatGPT these days. Because oftentimes I have complex questions where I’m asking for data comparison for example, asking for specific details [...] if I search the same query on Google then subsequently, I’ll have to read a lot of literature or articles [...] it [Google] kind of bring irrelevant stuff which is not really addressing my query, but chatGPT is able to understand what I’m trying to ask, and it is often able to respond to complex questions”. - Interviewee #5

5.2.3. Discipline specific Effects

One important aspect of our research is to understand how ChatGPT is affecting education across various disciplines and by using **Discipline** code we analyzed this theme. For this we interviewed professors from various disciplines as well as professors who have experience in pedagogy. We found out that there is a general influence of ChatGPT across various disciplines. However the nature of this influence varies depending on the discipline. One interviewee who has background in pedagogy explained it:

“[...] writing means something different in all these disciplines. So when you talk about writing in chemistry, for instance, or in engineering, it has a different meaning and also different norms and different different rules and all that in chemistry then it does in philosophy or if it does in the Fine Art. So if it's [ChatGPT] being used as a writing tool, it's going to need to be integrated and approached from vastly different perspectives depending on your discipline.” - Interviewee #6

“The philosophy, if you go into the humanities, it's mostly narratives. You need narratives, and they need to be unique and they can't be already said. In the sciences, you can't make a point that hasn't been made, five times published and you can refer. So it's different ways of approaching these things, requires different, I should say the different forms of writing in all of these different disciplines is gonna require different approaches. So I haven't seen a vast set of examples across disciplines at this point.” - Interviewee #6

This is also resonated by professors explaining ChatGPT's influence on their respective disciplines where some disciplines, mostly the ones that requires producing written work as part of their education, are affected more than the others:

"[...] all of this or if not most of them, maybe all of them are going to affect social sciences in its core competence, which is dealing with texts first of all. Secondly, managing large amounts of data which is in some of our social sciences, very important thing [...]" - Interviewee #1

"In my discipline, political science or the social sciences, one of the things this is putting a lot of pressure on is take-home exams and other alternatives to high stakes exams that we've spent years trying to put in place." - Interviewee #2

"In the arts and humanities, [...] teaching writing may need to fundamentally change. And they [University, Faculty] know that expository writing programs around the world are disrupted by this. They know maybe it's outdated to teach people to write the old way. But we're in a transition phase. And whether or not that transition takes three years, five years, six months, we don't know." - Interviewee #2

One interviewee mentioned a shift within computer science education due to automation of research. Because of ChatGPT, students are moving away from programming but at the same time it is increasing the demand of LLMs:

"In computer science, it's a really interesting and exciting phase. There are students walking away from these majors across higher Ed. This was demonstrated in the human AI index report from Stanford last week or two weeks ago. Just explaining that the numbers are shifting and students are going away from programming whereas they had just ran to it. It's automating huge chunks of research and education in computer science, it's creating new spaces in LLM where we haven't been hiring, recruiting or training people." - Interviewee #2

Another interviewee is under the impression that unlike social sciences and humanities, education in STEM (Science Technology Engineering Maths) discipline is not affected as far as issue of plagiarism is concerned:

"I've not seen anything in the STEM fields. In the STEM fields, what I'm seeing right now is, and again I don't have an exhaustive knowledge of it, but what I've noticed the most in the STEM field, they don't care because they don't write, like in a math class you don't write. So I don't hear a math teacher really talking about it much. Or they talk about it in terms of plagiarism and the issues that it poses for plagiarism." - Interviewee #6

Challenges related to plagiarism and citation also have different dynamics across different disciplines. One interviewee who has experience in pedagogy, discussed adoption of ChatGPT in social sciences and humanities considering the plagiarism concern:

“The plagiarism thing I've seen in all the disciplines, but I've seen the most interesting ways of trying to integrate and adapt to ChatGPT in the social sciences and humanities and that's where they're actually asking students to use ChatGPT to do certain things and to acknowledge that they're using it and incorporate it into assignments. And I think that's pretty much the only way to approach this, to take a very discipline specific integration approach.” - Interviewee #6

Another interviewee shared how it is changing information literacy particularly citation which is an important part of academic research:

“The conversations are around teaching information literacy way more than we were. Not just how to do a citation, but what is the authoritative voice? Because the challenge with ChatGPT is that there is no authoritative voice. You don't have the context of the author, the time, place, gender identity, intersectionality of the author, the safety within which or lack thereof that they're writing these kinds of things are missing. So it's changing how they teach information literacy in our writing programs.” - Interviewee #2

5.2.4. Effects on Quality of Learning and Teaching

This theme uses the codes - **Improve, Decline, Human Touch** to capture the responses of our interviewees regarding ChatGPT's effect on equality of education. It has not been long since ChatGPT was introduced, therefore not enough research is available in this area. Because of this some interviewees seem to be uncertain regarding the long-term effects of ChatGPT on quality of learning and teaching.

“I don't think we know yet. I don't think it's that widespread. I think we won't know until universities start to go through cycles of accreditation. And we start to see evidence of it in different places.” - Interviewee #2

However, as it is already being used in various academic settings as discussed in the previous theme, interviewees have started to observe its effect on the quality of education. We received mixed responses where some interviewees are optimist and think it will improve the quality of learning by automatic tasks and by pushing learning toward more sophisticated level:

“It will be able to check for consistency among sources which is a key skill for evaluation in the academy. So it's automating things that we normally take three years to develop in a learner” - Interviewee #2

“As an optimist. I do believe that this is going to improve learning and teaching, [...] I think learning can be enhanced by these technologies if we use them wisely and this of course is the critical issue. We don't know yet really in detail what wisely would mean, but we can see that for some of the routine things where you try to learn, derive the answers to sophisticated questions there ChatGPT might help [...] so I think yes, this will affect teaching and learning,” - Interviewee #1

“I like what ChatGPT does because it [...] makes creation so easy that there's probably a lot of work to be done on helping students be able to evaluate content. So ChatGPT can just whip out a like, give me an explanation of Hamlet, you know. And you see an explanation and you see maybe two or three of these things, do they have the skills to be able to say this explanation is better than this one because of that? And that's a sophisticated learning process” - Interviewee #6

However, a number of respondents identified issues where the quality of learning is, or could be, in decline in a particular context:

“I don't know the long term impacts, but we definitely have students who are cutting corners with it already even on formative assessments where there's no grades. [...] Some students have clearly started using ChatGPT to develop their prompts. They're not as sophisticated in the answers, they are sometimes off topic and it's a waste of time to read them.” - Interviewee #2

“So students obviously are not going to use most of their brains if the teacher is not conscious enough, when the teacher is not able to verify or understand the responses that are going to come. The written assignments, basically coming from students, are actually created by ChatGPT or some similar, so that's one of the main concerns.” - Interviewee #5

“We also checked how well it can write new texts. So we compared those human writings for scientific texts and machine writing of scientific texts, which was pretty disastrous because ChatGPT invents things which is not exactly a scientific method.” - Interviewee #1

“One thing which I'm noticing while I use ChatGPT specifically when I'm trying to write something, is that there is a very strong temptation to just outsource the whole writing process to ChatGPT, because sometimes I have to think very hard to gather my own thoughts and to structure the sentences. [...] So I sometimes find it hard to just structure the whole sentence and I really have to think hard about how to express it the most academically in an academic style. Eventually, when I'm using this, though, there's a very strong temptation to just outsource the whole writing process to ChatGPT and this, I believe, sometimes has compromised my writing efficiency as well.” - Interviewee #5

Some interviewees were of the opinion that in order to improve the quality of education, ChatGPT should be an integral part of education rather than an escape from it:

“One of the first things I think is to integrate it into the learning. To pretend like it's not out there and it's the enemy, I think it is really gonna limit the kinds of learning that can be done with it. So once integrated, if I were to be using this, I would be using it along the lines of what I've described is, in a way that is independent of ChatGPT, I would be teaching, working with students to learn the fundamentals of a particular topic, to learn the conceptual landscape of a particular topic, to learn how to analyze.” - Interviewee #6

“If we don't include AI, the quality of teaching and learning is going to decrease. Because it's human nature to find the easiest path. [...] so it's reasonable that they [students] would use a tool to help them with their assignments. But what they need to learn is how learning happens and whether they're helping or hurting their learning by using that tool in that way. So if we don't do that then they're going to start leaning more on the shortcuts and not learn as much.” - Interviewee #7

The need for human supervision of ChatGPT to improve quality was another important point discussed by respondents:

“A real student, a real human now needs to sit on top of AI and not be underneath it. So they need to sit on top of that and say this is really good, this is not really good because of that. And right now ChatGPT and AI systems can't really do that[...] we now need to learn how to rise above it and to put in more human needed thinking and intelligence to help compliment what the computers can do, and I think ChatGPT is a good example of that.” - Interviewee #6

“[...] let's think critically about the output of AI because we're going to start seeing a lot more artificially generated content in the media, online, social media and the news. And we're gonna have to figure out that I really see the Pope and a puffy jacket. Was that real or was that generated? So it's going to become a super important skill for students to be able to evaluate what they're seeing. And they're not going to be able to figure a lot of that stuff out if they don't understand how the AI works, if they are not able to generate those things themselves.” - Interviewee #7

5.2.5. Teacher-Student Interaction and Methods of Teaching

This theme focuses on understanding how the teacher-student interaction in the current educational system works, and most interviewees reflect on their interactions with their students as well as the use of ChatGPT in class. Various codes are used to analyze, including **Classroom, Teacher-Student Ratio, and Personalization**. The interviewers commented about their unique approach to interacting with students:

“My teaching is basically based on talking and on interaction between humans and to prepare that kind of interactions.[...]teaching in person, which means in the classroom with interaction between professors and students.” -Interviewee #1

“I'm asking students to think about certain things and search certain things on Google using their cell phones they have with them inside the classrooms. Or if they're carrying any laptops, then they can actually search stuff and have a more informed discussion about a particular topic.” - Interviewee #5

“It actually boils down to this dichotomous relationship that already exists between the teachers and the students in this typical university's educational structure that we have[...] students are trying to get away from the process of learning, and teachers are somehow trying to drag them back into the process of learning.”-Interviewee #5

Some interviewees draw particular attention to how changes in technology and resource accessibility have altered traditional educational structures, teacher-student interactions, and methods of teaching:

“The teacher-student classroom setup actually has already been affected by the voluminous teaching materials that are already available on YouTube[...] the classroom is not constrained to four walls. So the entire world is your classroom now, I think you don't need to depend 100% on a professor whatever level you are in.” - Interviewee #4

The interview also discusses how they want to use LLMs, particularly ChatGPT, to change the way they teach in the upcoming semester. discussions on the need to adapt teaching and learning techniques to take advantage of technology, particularly ChatGPT:

“But now this semester it's definitely gonna change the way I teach, like, day one I will be having them download edge and start using Bing. And I will not be having them[students] create all their own lesson plans anymore. Instead, I want them[students] to develop the right kinds of prompts to ask Bing to create the lesson plans for them. And then I want them[students] to critique the lesson plans. I want them to explain. These activities, how are they going to help the learner? So I also teach them about how learning happens” - Interviewee #7

“When we got to the point in the semester where I was introducing this assignment and getting the [students] ready to start working on it, I pasted the entire assignment into ChatGPT and asked one of them to give me their topic. Like just the title and GPT produced the whole research proposal in 30 seconds. And I showed them that and they're sort of in shock. And I said you can do this and skip the whole experience, but why did you come here? So we had a conversation about that.” -Interviewee #2

“I want them[students] to have to develop collaborative relationships with their learners, where the students learn to trust them and they learn to trust their learners so they learn how to use AI effectively. to help students learn. it's another tool in the toolbox.” - Interviewee #7

A technology like ChatGPT can be beneficial because it has been demonstrated that most faculty members themselves do not have the time or energy to connect with students or respond to all of their questions:

“my own university or University of Vienna for example, where there are, say, 10 professors for 5000 students then in an AI based system giving answers might be a help to students who would not have any way, would not have access to professors because there are too many students and too few professors, so that that might help them.” - Interviewee #1

While several respondents voiced concern about replacement, others refuted the assertion:

“I had a moment when it was first presented to me[interviewee] of fear, what does this mean for me as a teacher? What does this mean for me as a human? How will this impact how I teach classes? Will I know students have cheated? Those questions have come up with myself.” - Interviewee #3

“If it can replace you, you weren't doing a good job. So if all you are doing is transmitting information to students, AI can do that and we don't need you. But if you are developing relationships with students, if you are understanding what their needs are, if you are understanding how to teach in a way that is most beneficial for them, those are the things that AI can't do. And those are the things that it's gonna be really hard for AI to learn how to do those things[...]And those are the kinds of things that really make a good teacher.” - Interviewee #7

The respondents talked about many teaching strategies that help them instruct students effectively, such as problem-based learning and flipped classroom models:

“By using flipped classroom models, I put more of the learning in the hands of the students and then I was there as the guide, guiding them through what they were doing to learn. So that's what I really see my role as now is as a facilitator.” - Interviewee #7

“How am I preparing you to solve problems? And what problems are those going to be? So you know the problems of education that they need to solve? How do I help students master these standards? How do I help them engage in learning so that they want to learn and that they want to continue to learn? How do I develop trusting relationships with my students? How do I uncover my own biases and my students' biases?” - Interviewee #7

5.2.6. Assignments, Assessments and Grading

This theme is analyzed using the codes - **Assessment, Grading, Assignment**. Assignments and grading are one of the most important aspects of education, alongside lectures and discussions. ChatGPT's heavy reliance on written assignments, which are no longer reliable, has affected overall assessment and grading:

"I've seen from a lot of my colleagues as well again that initial feeling of fear with ChatGPT. How we know if students have cheated, and I think that will be all the way from elementary school on up through higher education. I think that fear will be prevalent" - Interviewee #3

"It changes long term memory for students, and it changes how we measure long term memory or the value we place on it. And so grading becomes more expensive" - Interviewee #2

"[...] if we don't start changing the way that we assess students then you're not going to know whether it was the student that performed the work, or if it was an AI that submitted whatever it was that they submitted." - Interviewee #7

"We never really know who's producing these texts that students bring into the classroom. We hope, we often just sort of turn a blind eye and say we hope that the things that they bring in are things that they've written themselves." - Interviewee #6

"So when the assignments are given, when you're supposed to write an assignment, the ChatGPT is not going to personalize for you, right? And these days, students are like, "I don't know, some may be lazy enough to not even personalize for them, just copy paste." - Interviewee #4

One professor whose education and research focuses on assessment, sees this as a good thing that will push teachers to rethink their approach not only towards assessment but towards teaching as a whole:

"It will force teachers to have to consider authentic ways of assessment where it can only be used as a tool and not as a copy-paste exercise. [...] let's go ahead and do a research and action report where you do initial research that perhaps ChatGPT or other things start you on. But then you have to apply it to your own sort of experiment. [...] they're not gonna just go and have ChatGPT come up with something for them. They're going to start there and then apply it in some sort of project based learning." - Interviewee #3

"I teach courses on effective assessment practices. So I have to manage that sort of emotion around like, how am I going to assess students? So I can't run away from that, or just be like oh, I can't use it, or I have to stop my students from using it.

Because it's clear this is the way things are going to be going. So I might as well engage with it as much as possible in the beginning, in ways that are appropriate.” - Interviewee #3

In order to tackle the challenges regarding assignment and assessment, some interviewees shared different approaches which they are taking:

“I think it will require us to develop assignments that are really, really specific and authentic, and there's not a lot of that work being done in higher education at all.” - Interviewee #3

“I asked students to watch a documentary and submit the summary, and I asked specifically that they should take notes, handwritten notes on the notebooks and once they're done taking notes while watching the documentary they should take a picture of the notes they have taken and submit those notes so that I can say that they have actually watched the documentary or not, or they've been able to understand what documentary is talking about. And also warned them that if I sense any kind of cheating then eventually I'm going to ask them to personally explain it to me in a face to face meeting, what they actually understood from the documentary. So these are the concerns. And this is one of the ways I'm trying to address those concerns.” - Interviewee #5

“So a really good practice is to take whatever assessment you're using and submit it to ChatGPT or to Bing and see what it comes up with and if the AI can complete your assessment and do well with it, you probably need a different assessment.” - Interviewee #7

“[ChatGPT] putting pressure to go back to a blue book with pencils, which does not support neurodiverse students, is anxiety provoking, not good for the learner and is not demonstrative of the kinds of skills you'll need in the workplace. It's an outmoded way of doing it, but you need to verify skills, so there's this short term challenge and assessment and social sciences. Where everything's coming back face to face.” - Interviewee #2

5.2.7. Academic Integrity and Ethical Issues

This theme focuses on examining the impact of the widespread use of LLMs on academic integrity, using various codes such as **plagiarism**, **hallucinations**, **copy-paste** and **bias**. It is crucial to recognise that this technology is here to stay and that policies need to be developed on how universities can effectively address academic integrity concerns, rather than resorting to outright bans:

“[...]So it is my intention to prepare together with the students for this kind of next step into the future where we will have the assistance of AI based systems in teaching[...].” - Interviewee #1

“[...]And there we have of course an issue if texts are not written by students, but ChatGPT, but this is a fact of life[...] At the time when calculators were invented. Some professors said, well, this is going to be the end of the brain because the brain doesn't know how to calculate $3 + 5$ anymore, so I think it's a similar situation. We need to learn how to make best use of it. Also in scientific work there is a lot of routine work which could be done by machines and should be done by machines.” - Interviewee #1

Some interviewees were contemplating the presence of plagiarism and copy-paste practices in education even before the introduction of chatGPT. However, they emphasize that the ease of output generation with AI technologies has made the issue more crucial to address. As a solution, respondents suggest the importance of citing the contribution of AI when using it for specific tasks:

“We never really know who's producing these texts that students bring into the classroom. We hope, we often just sort of turn a blind eye and say we hope that the things that they bring in are things that they've written themselves. There is a constant treadmill of plagiarism “ - Interviewee #6

“The plagiarism thing I've seen in all the disciplines, but I've seen the most interesting ways of trying to integrate and adapt to ChatGPT in the social sciences and humanities and that's where they're actually asking students to use ChatGPT to do certain things and to acknowledge that they're using it and incorporate it into assignment” - Interviewee #6

However, it is important to note that not all of the output generated can be directly copied, as there are cases where the technology hallucinates and produces content that does not exist. In addition, respondents acknowledge the presence of distortions in the outputs generated by the technology:

“Oftentimes the response which I get from ChatGPT is biased in certain ways. So one has to be careful while asking stuff.” - Interviewee #5

“Sometimes I ask stuff about the specific political ideologies of the left side, the left wing, and it seems to have a bias in favor of that side, and I think there was already some controversy going on. Elon Musk recently also announced that we are going to create a TruthGPT, where the whole platform is not that biased in favor of the leftist.” - Interviewee #5

“So we compared those human writings for scientific texts and machine writing of scientific texts, which was pretty disastrous because ChatGPT invents things which is not exactly a scientific method.” - Interviewee #1

Respondents agreed that addressing the impact of LLMs is a societal issue and that universities have a crucial role to play in developing guidelines and policies to govern their use. It is also important for universities to educate both professors and students about the responsible and effective use of these technologies:

“It's a social issue, it's an issue where we have to find a solution on the society level and not so much on the individual level.” - Interviewee #1

“we change from written exams again to oral exams because there you can see how competent students are when they express themselves orally. So in that sense there are ways of progress or ways of living together and having a better scientific life with ChatGPT than before without.” - Interviewee #1

“I have no problem if you [students] use ChatGPT or any other AI function, or even any other resources, [...] if you're using these resources as long as you cite them, and then include a paragraph about how you modified them so you should always approach these AI, the work that you do with AI as a starting point, because it can spit out a lot of nonsense as well. So we worked through it with that sort of approach.” - Interviewee #3

Another interviewee emphasizes that simply copying answers will not benefit students, as it fails to fulfill the fundamental objective of learning:

“You can cheat, you can have AI make these things, but you're not learning. So here's how learning happens. You know, with some things that you need to struggle through because learning is hard, so those things, let's not use AI for that. But when we just need to save time and have AI help us either with brainstorming or with menial kinds of tests, let's use AI for that[...].” - Interviewee #7

5.2.8. AI Awareness and AI Literacy

Using the codes of **Prompt Engineering**, **Teach teachers** and **Awareness**, this theme highlights the importance of AI literacy and awareness in the effective use of these tools for increased efficiency. In addition, the drawbacks of over-reliance on such technologies and their impact on the learning process will be explored through various related themes. With the emphasis on the longevity of this technology, it is imperative to proactively prepare for the future:

“My position or my understanding of ChatGPT is that this is a technology which is not going away again. So this is something which will be part of our daily life both in the private context as well as in the professional context and also in the scientific context. So it is my intention to prepare together with the students for this kind of next step into the future where we will have the assistance of AI based systems in teaching and in publishing as well as in organizing our work and the earlier we make our experience the better for all of us.” - Interviewee #1

The consensus among the interviewees was the time-tested notion that the training of teachers is a crucial first step in the promotion of a better learning experience for students:

“Teaching teachers is a fundamental principle when you have any kind of new development there.” - Interviewee #1

“we're gonna have to teach teachers about AI.” - Interviewee #7

“so they really need to develop their own digital literacy and that now includes AI literacy” - Interviewee #7

To effectively harness the power of tools such as ChatGPT, it is vital that individuals have a comprehensive understanding of prompt engineering. This knowledge will enable them to take advantage of the inherent benefits and advantages offered by such technologies:

“There isn't a lot out there on how to teach people how to become "prompt engineers", what I think this is ultimately all about, on the practical, on the work side, on the skill side.” - Interviewee #2

Respondents also highlighted the detrimental effects of over-reliance on such tools, which can hinder the learning process for students. Consequently, they emphasized the importance of analyzing content, understanding argumentation and developing awareness of how to use technological tools effectively in education:

“We should not align towards that like we should align the ChatGPT for us. So that we don't get dumb, technology should not make us dumb. We should make technology helpful for us to grow. So the skill one has to have, students have to have.” - Interviewee #4

“Students need to learn how to critically evaluate generative output and right now, that's not a CLO on any syllabus.” - Interviewee #2

“ So there is a danger in becoming over reliant on AI just like with calculators, a lot of people reach for a calculator rather than doing the calculations in their head. But if you don't do calculations in your head, you start to lose those basic math facts that you learned[...]So that's really where AI can help offload some of the things that we don't need to be spending our energies on. It can help us be creative because it could spark ideas that we might not have thought of before. And creativity is not actually generating brand new things. It's finding new ways to put old things together.” - Interviewee #7

Another interviewee points to the need for a strong AI foundation, while ensuring humans remain in control and collaborate efficiently without overdependence:

“You probably would need to be able to produce an essay, but given that we can make essays now just by clicking buttons. A real student, a real human now needs to sit on top of AI and not be underneath it. So they need to sit on top of that and say this is really good, this is not really good because of that.” - Interviewee #6

“That's going to be the way that I think things are from now on is that we're going to have to be AI literate and we're going to have to teach students to be AI literate.” - Interviewee #7

“AI can play a lot of these different roles that we needed humans to play before, we now need to learn how to rise above it and to put in more human needed thinking and intelligence to help compliment what the computers can do” - Interviewee #6

5.2.9. Guidelines, Policies and Challenges for Integration

The primary objective of this theme is to delve into the challenges surrounding the integration of LLMs, particularly ChatGPT, in higher education, with a specific focus on universities. Several codes, such as **AI ethics**, **regulations**, **guidelines**, and **bans**, were employed to analyze this topic comprehensively. Each code was carefully examined to capture the diverse insights provided by the interviewees:

“Universities as institutions are gonna have a hard time. coming up with policies[...] how are we going to regulate the use? What are gonna be the rules of engagement? What's gonna happen? When you write those policies, you have to be aware that probably 80% of the teachers are not gonna want to or be able to use this in their coursework, and 20% are gonna really want to[...]But I think that's where I would be looking next is to see how institutions are making systematic responses to this.” - Interviewee #6

Respondents also emphasize the resistance to change within the education system and the considerable effort required to establish guidelines and policies for the integration of such technologies:

“Schools just made the technology fit into what they were already doing and allowed for some allowances and some accommodations. But schools were very good at continuing to maintain a transmission model of learning and control of the learning.” - Interviewee #7

“One thing that's been interesting to me is conversations around whether or not to develop an honor code for universities and why that's so controversial, like it seems like an obvious, easy win and something you can do with students collaboratively. [...] I'm hearing from lots of universities as this might be one of their response items, but then it goes into committee and dies.” - Interviewee #2

As technology companies increasingly release such large language models (LLMs), it is crucial to consider the implications and potential consequences:

“It's very unclear who is liable if something happens, who is accountable for what these machines are doing, and just to download this to the end user is not the solution and we need to see a much more sophisticated policy.” - Interviewee #1

However, it is recognised that banning such technology is not a viable solution. Instead, the focus is shifting to exploring how professors and students can benefit from collaborative engagement with this technology:

“And computers were banned in a lot of places. They didn't want students to cheat, looking up the answers. They didn't want them getting access to porn. There were a lot of reasons why they controlled access to computers[...] But the students are going to learn it on their own. So what do we want them to learn? If we wanna shape what it is that they learn, we need to be doing the teaching.” - Interviewee #7

5.2.10. AI Divide, Inequity and Inclusion Challenges

The focus of this theme is to explore the impact of widespread adoption of LLMs, particularly ChatGPT, on inequality and the exacerbation of existing digital disparities. The codes **Inequity** and **Digital Divide** is used to analyze this theme. Interviewees engage in discussions that highlight how students from different academic backgrounds have different learning needs. The interviews shed light on the concern that if students are unequal in their access to technology and AI tools, it can result in long-term disadvantages in their lives:

“ChatGPT finally landed, we've had AI in education for a while, but it's been exclusive. It's only been schools that can afford the tools or that have a research partnership with someone that's developing an intelligent tutor[...]"
- Interviewee #7

“Digital divide, we see the technology haves and have nots [...] it was really magnified in the pandemic[...]a lot of that is tracked with demographics of low income or minority or disabled students that are already at a disadvantage. They're further put at a disadvantage because of the digital divide. There will be an AI divide as well. They're going to be at a disadvantage in their learning, but they're also going to be a disadvantage in life [...] They won't be able to get good jobs. There's a lot that they will be missing out on. it will be a big problem if we don't. If we don't start using AI in teaching.” - Interviewee #7

“My major concern with this tool is widening inequalities. So there's potential in ChatGPT for breaching inequity and breaching gaps. But I don't really see technology as being used in that way. There's always potential for technology to be used in productive ways that reduce inequities. But I just don't see that as being the reality, the potential is there but the reality doesn't always exist.” - Interviewee #3

The interviewee provides a concrete example to vividly illustrate and reinforce the point they made:

“And so what I see is, for example, those students who are already great with English, who know how to ask the right questions, who are comfortable with technology[...]Whereas those students who are struggling with English who are afraid of technology who don't have access to technology have to start from scratch or only use it as a copy and paste[...] I think the way that technology uses benefits those at the top already, and I think this is one of those tools that has the power to benefit those at the top and does very little for those at the bottom.” - Interviewee #3

They also emphasize the role of universities in empowering students by providing them with necessary tools and resources:

“There's been a lot of studies that have shown that orientations and not just orientations to universities like, here's the library, and here's this and here's that but orientations to technological tools really help develop self-efficacy, especially student self-efficacy, learning self-efficacy[...]So I think that that's one key thing that you could do is ensure that all of your students come in with some level of knowledge about how to use and skills about how to use these various technological tools, including AI” - Interviewee #3

5.2.11. Nature of Disruption and Future Possibilities

The **Disruptor** code has been used to investigate the effects and transformations brought about by large-scale language models, with a particular focus on ChatGPT. With a particular focus on the recent disruption caused by the introduction of ChatGPT by OpenAI, the code delves into the various factors that contribute to disruption in the education sector. Discussions also included the advances brought about by the Fourth Industrial Revolution, which played a crucial role in enabling the transition to distance learning during the pandemic. The introduction of ChatGPT emerged as a major point of discussion among those interviewed, with some expressing excitement about its potential to evolve, while others highlighted the need to shift paradigms to effectively adapt to its impact:

“I was really excited because that's really when the Internet around 2000 is when the Internet really started making its way into classrooms and into schools. And I thought, oh, this is going to be disruptive, this is really going to change what we're doing in school. So now it's really exciting.” - Interviewee #7

“I was really excited about the pandemic, how that was majorly disruptive and that was going to change and people were gonna realize, you really can do a lot online, remotely. And teachers worked really hard and some of them had a little bit of a paradigm shift realizing that it's OK to give up control because I can't really control what these students are doing in their homes[...].” - Interviewee #7

The emphasis on teacher reflection on pedagogy has been facilitated by the presence of various disruptors in education:

“I personally very much enjoy things that emerge and disrupt education. I think it's fantastic. I'm not saying AI and ChatGPT in general are fantastic, but I love the disruptive qualities of something like ChatGPT because it's very rare that teachers sit back and think about their pedagogy, like university teachers, professors sit back and really reflect hard on their pedagogies. The pandemic did that and I see ChatGPT doing that.” - Interviewee #6

“it will change like post COVID it has already changed, the covid is actually put upside down everything. So we didn't even dream about having an online class, but that did happen” - Interviewee #4

The interviewees concur that this technology is disruptive and will soon evolve by showing how it functions as a tool and how it may be the future of search:

“it will probably end up being a tool similar to Google, not in that they do the same thing. It's not a search engine. I understand that difference very clearly,

but a tool again, it's this tool that you can use in a variety of different ways for a variety of different purposes, and we will refine that.” - Interviewee #3

“I believe that it's a good starting place, and it will likely develop as a better and better and better tool. As technology moves forward, we become more refined in our use of it. As more platforms are being used, this is something that's going to evolve.” - Interviewee #3

*“For me, it's a small piece of a much larger puzzle, which is the 4th Industrial Revolution. [...] It just happens that this technology in particular disrupts education, whereas a lot of the other technologies disrupt work and have implications for what the nature of expertise is and what universities do. “
- Interviewee #2*

By underscoring the critical role that universities can play in embracing this technology, a multitude of future possibilities can be generated for its integration into education:

“I guess the role is it's a disruptor. It will create massive efficiencies on the administrative side. So that's a disruption in and of itself. Now, whether or not universities then say, OK, you don't need admins because faculty you're now, you can automate that work and do it yourself. That's one way some universities will go, which will make work even harder for faculty.” - Interviewee #2

“But as a disruptor, I think it has the opportunity to freshen the curriculum. This has to come from accreditors, they have to require it. Or there's little incentive for the administration to do that. But ultimately, if students aren't prepared for the job market, universities won't be worth a piece of paper they say they're verifying skills on that aren't there. That's why it's a disruptor also.” - Interviewee #2

5.3. Survey

This section presents the findings of the quantitative phase of this research study. It begins with an examination of the demographic characteristics of the sample, followed by a presentation of additional collected data.

5.3.1. Demographic Data

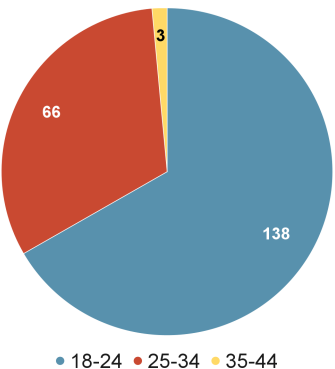


Figure 8: Distribution of age

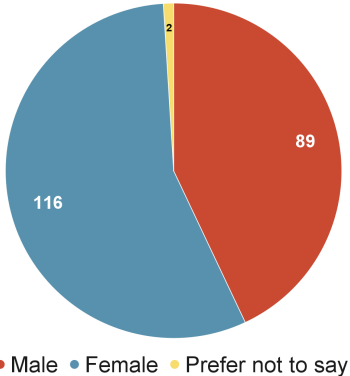


Figure 9: Distribution of gender

Figures 8 and 9 show the age and gender distribution of the research sample. It indicates that the sample consisted of a diverse representation of both men and women, with a slightly higher proportion of women respondents. Also, the dominance of the 18-24 age group within the sample suggests a substantial representation of young adults in the study.

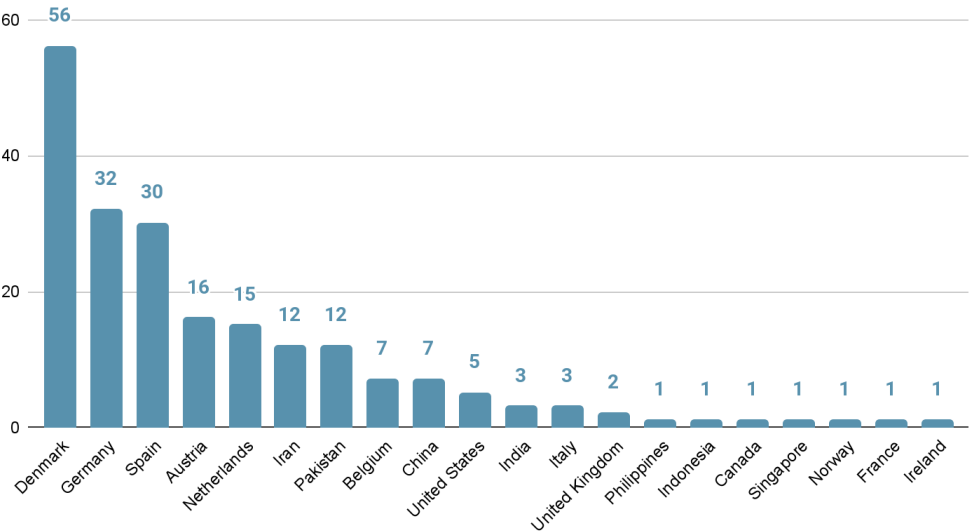


Figure 10: Distribution of country of study

Figure 10 displays the distribution of countries, revealing that a significant number of survey respondents were studying in developed countries, primarily in Europe. Nonetheless, data from other countries were also collected and considered.

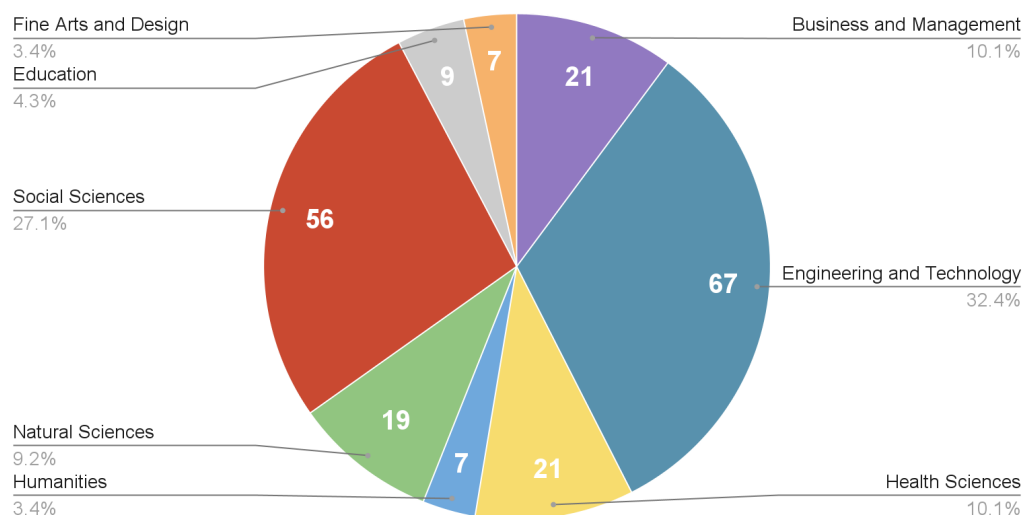


Figure 11: Distribution of discipline of study

As shown in Figure 11, the sample included students from various disciplines. Engineering and Technology, along with Social Sciences, had the highest number of participants, while other disciplines were also represented.

5.3.2. Usage and Knowledge

The analysis in this section will address the third research question, which pertains to the current usage of LLMs by students and professors.

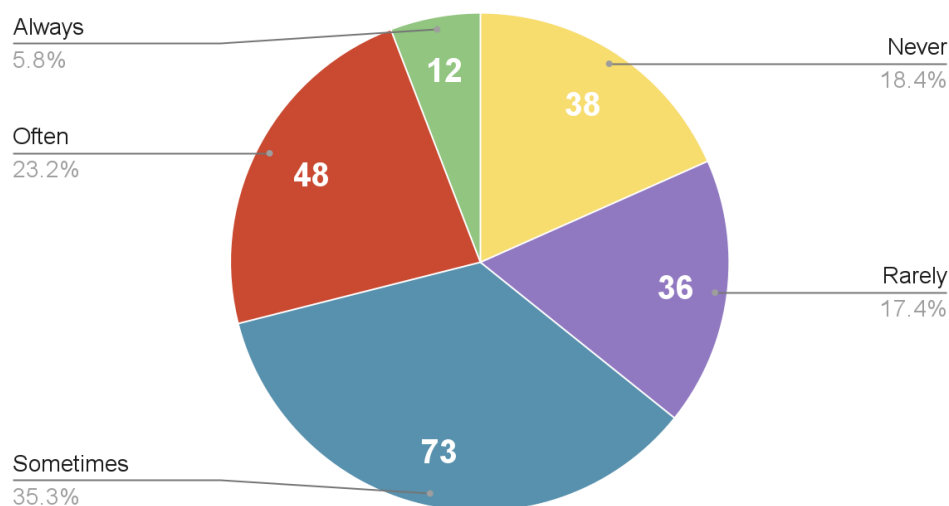


Figure 12: Students' frequency of usage in their studies

Even though LLMs like ChatGPT are relatively new, figure 12 illustrates that the majority of students use them in their studies with a relatively high frequency.

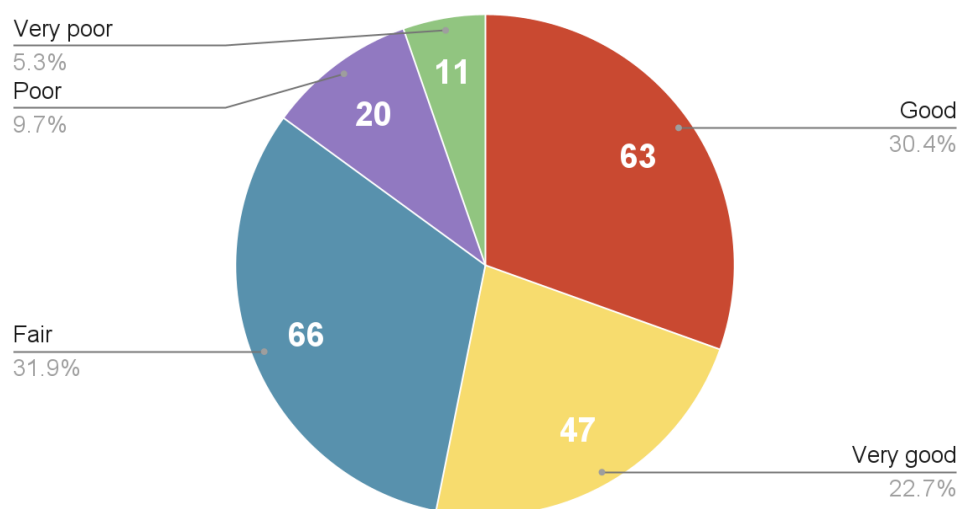


Figure 13: Students' knowledge about ChatGPT or similar tools

Furthermore, the survey results indicate that only a small proportion, specifically 15% of the sample, reported having poor or very poor knowledge of ChatGPT or similar tools. Figure 13 suggests that the majority of participants in the study considered themselves to have a good or very good understanding of these tools.

We should also point out that while only 15% of the sample reported having poor or very poor knowledge about LLMs like ChatGPT, a significant proportion of 35.8% indicated that they rarely or never utilize them. It shows that some students demonstrated limited involvement or utilization of these tools in their studies in spite of their knowledge. Thus, even among those who are knowledgeable about LLMs, there may be various factors influencing their adoption and usage patterns. Understanding these factors can provide valuable insights into the barriers or motivations related to the usage of LLMs, further enriching the understanding of their role and potential impact.

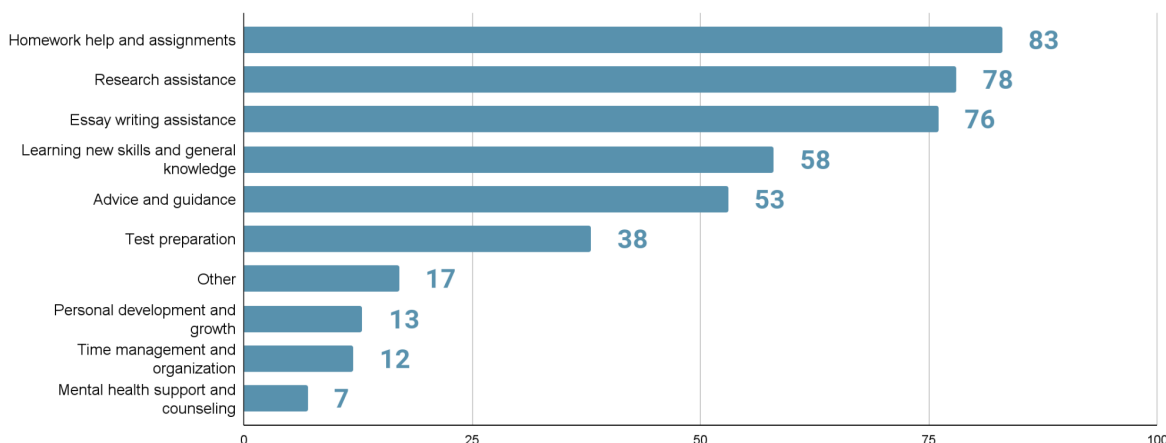


Figure 14: Students' purpose of using ChatGPT or similar tools in their studies

Figure 14 illustrates the purposes for which students use ChatGPT or other similar tools in their studies. The primary purposes indicated by students were seeking help with homework and assignments, obtaining research assistance, and receiving support with essay writing.

Some respondents specified coding, summarizing long texts, and brainstorming as other reasons for using these tools. As a result, ChatGPT or similar tools are seen as useful tools for educational support and enhancing productivity in academic endeavors.

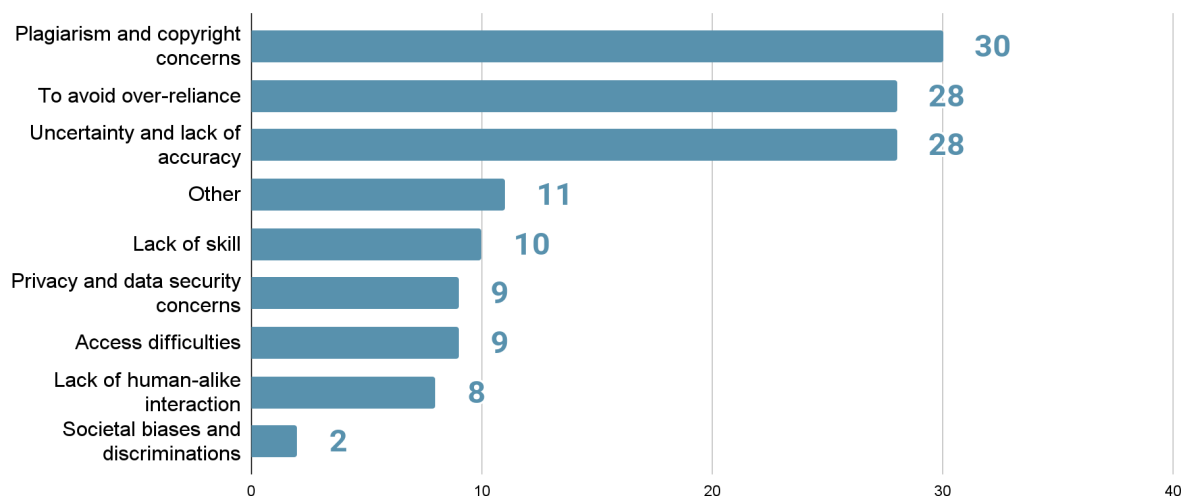


Figure 15: Reasons that prevent students from using ChatGPT or similar tools

An important finding of this survey is the primary reasons that hinder students with knowledge about LLMs from using them. These reasons include concerns related to plagiarism and copyright infringement, the desire to avoid over-reliance, and uncertainties regarding accuracy. Some participants specified their unwillingness to use ChatGPT and similar tools due to perceived inefficiency, ensuring possession of the necessary skills and knowledge for graduation, lack of necessity, and restrictions imposed by university regulations.

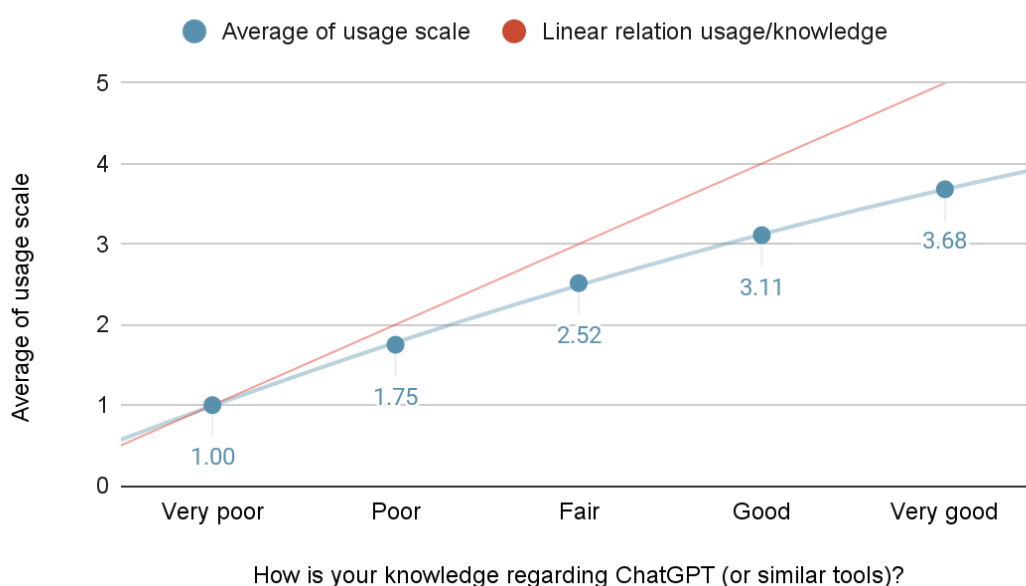


Figure 16: Correlation between knowledge and usage

Figure 16 provides another interesting insight into the usage and knowledge of ChatGPT or similar tools. It is fascinating to observe the usage patterns across different knowledge groups and determine if there is a linear relationship between knowledge and usage. Upon examining the collected data, it becomes apparent that instead of a linear progression indicated by the red line, the data follows a more logarithmic trend. This means that as knowledge about these AI tools increases, there is generally an increase in usage. However, at higher levels of knowledge, the usage tends to decrease compared to what would be expected in a linear progression.

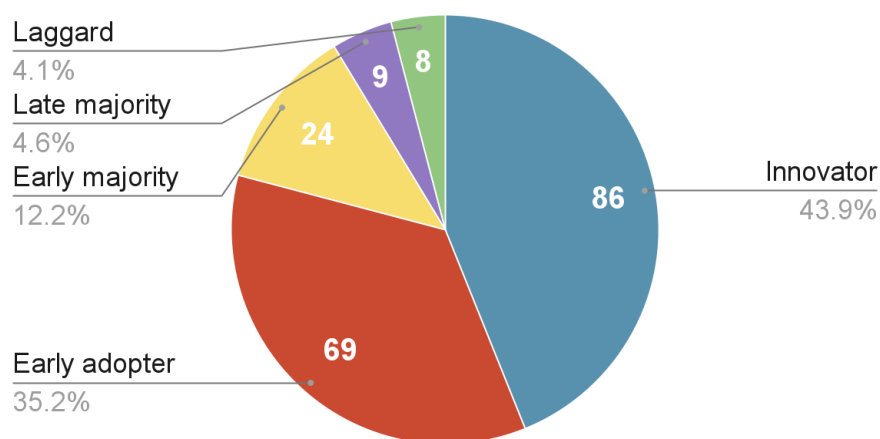


Figure 17: Distribution of adopter profile

Students were also asked to assess their level of technology adoption when it comes to new technologies like ChatGPT. This measurement is valuable for profiling the sample and understanding their propensity to adopt technological innovations.

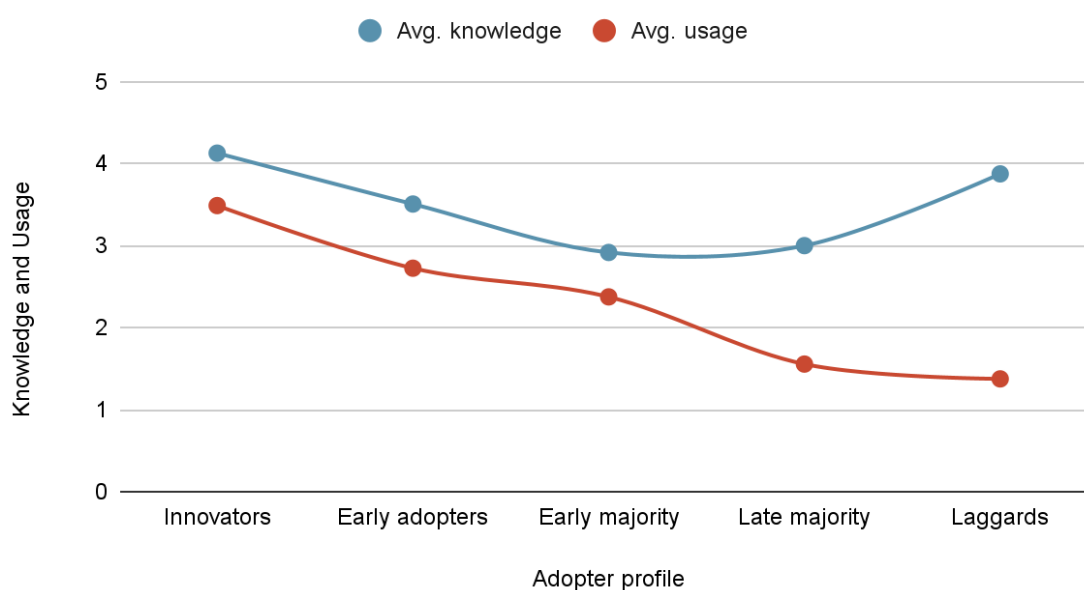


Figure 18: Correlation of adopter profile with knowledge and usage

This analysis allows for a deeper understanding of the relationship between participants' technology adoption tendencies and their actual engagement with ChatGPT, shedding light on factors that may influence their adoption behaviors and usage patterns.

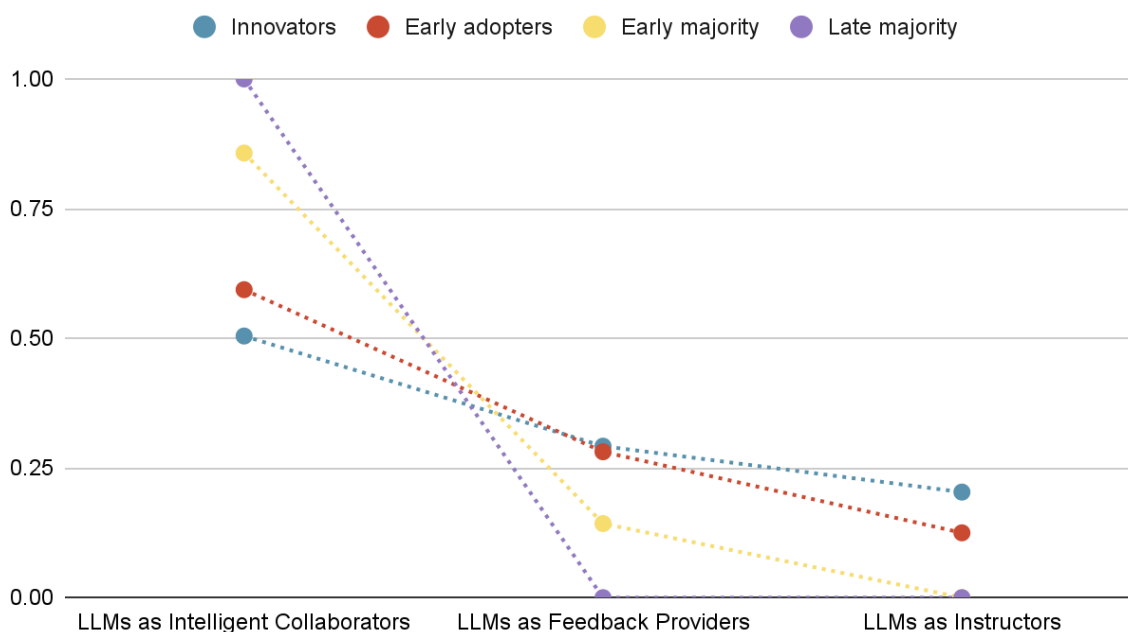


Figure 19: Role Distribution for Adopter Profiles

The line graph in figure 19 depicts the percentage distribution of LLMs' roles for each adopter profile. Across all adopter groups, the role of Intelligent Collaborator emerges as the most preferred, followed by Feedback Provider and Instructor, which is consistently the least chosen role.

Although the order of roles remains consistent (Intelligent Collaborator, Feedback Provider, and Instructor), the percentages vary among the adopter profiles. As the adopter profile shifts towards more innovative individuals, the distribution of roles becomes more evenly spread, with a reduced proportion of Innovators opting for the Intelligent Collaborator role and a greater proportion of Innovators choosing the Instructor role compared to less innovative profiles. Lastly, it is important to acknowledge that because of survey flow, there is no available data from Laggards in this analysis.

5.3.3. Role of ChatGPT (or similar tools)

This section will delve into how the role of ChatGPT (or similar tools) in higher education changes according to students' discipline of study.

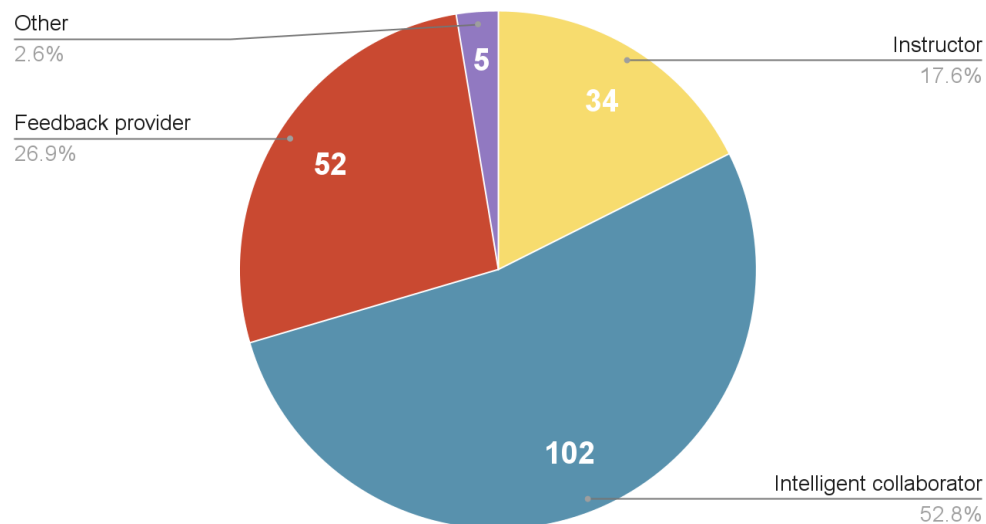


Figure 20: The role that ChatGPT or similar tools fulfill for students in their studies

Figure 20 shows that 52.8% of the sample identified ChatGPT as an Intelligent Collaborator in their studies. Also, 26.9% of participants selected the role of Feedback Provider, while 17.6% chose the role of Instructor. Some participants explicitly mentioned that these tools primarily assist them with tedious tasks and serve as a source of inspiration.

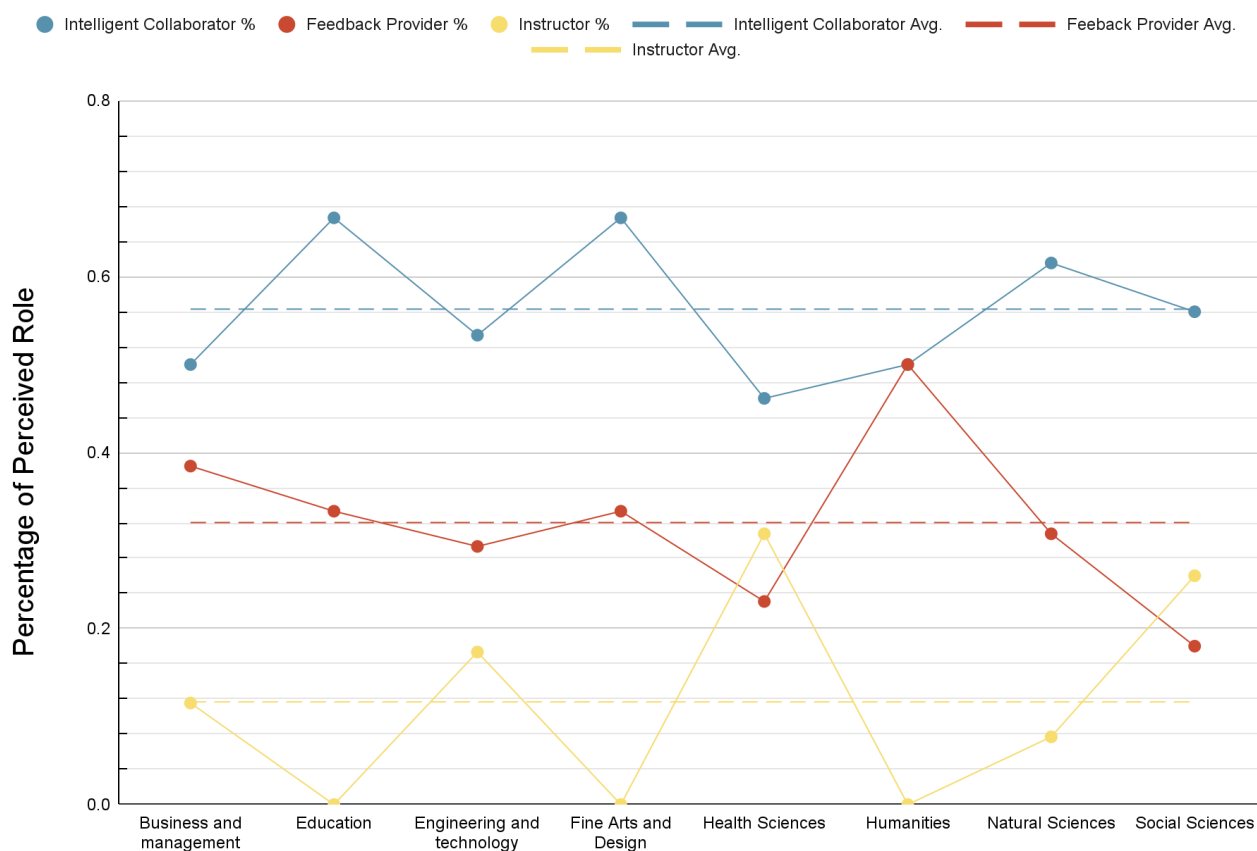


Figure 21: Correlation between Discipline of Study and Role

The survey data suggests a correlation between the discipline of study and the percentage of students attributing a specific role to ChatGPT (or similar tools). Figure 21 demonstrates a general trend where the majority of disciplines perceived these tools primarily as an Intelligent Collaborator. However, there are certain noteworthy cases.

For example, in the disciplines of Social Sciences and Health Sciences, students perceived ChatGPT (or similar tools) more as an Instructor than as a Feedback Provider. Conversely, the discipline of Humanities showed an equal rate for an Intelligent Collaborator and Feedback Provider, while no student in this discipline perceived these tools as an Instructor. Nevertheless, the relatively smaller number of survey respondents from the humanities discipline should be acknowledged here. In terms of the students from Engineering and Technology, it is notable that they tended to perceive ChatGPT (or similar tools) as less of a Feedback Provider and Intelligent Collaborator compared to students from other disciplines. However, they viewed these tools as an Instructor more frequently than the average among students from other disciplines.

5.3.4. Quality of Learning

Concluding the quantitative findings of the survey results, this section will analyze the data collected from students to explore the impact of LLMs on their quality of learning. Furthermore, the degree of correlation between these changes in quality and the specific methods of teaching employed by students' universities will be assessed.

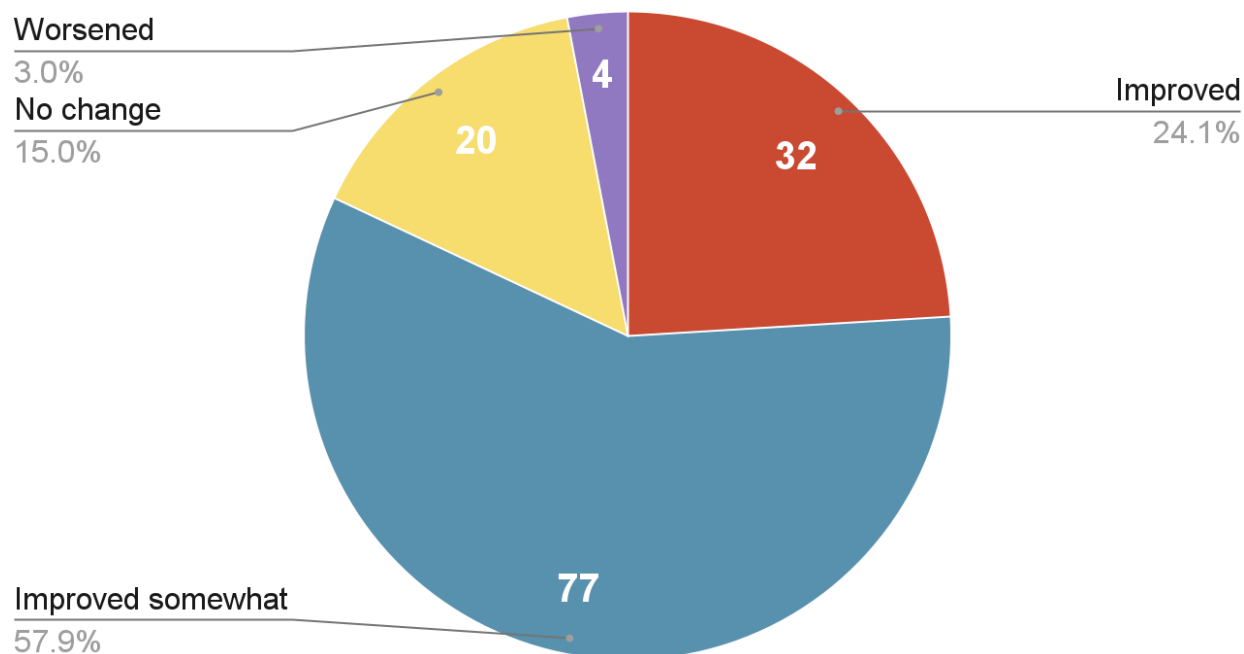


Figure 22: How ChatGPT or similar tools have changed students' quality of learning

According to Figure 22, the majority of students, precisely 82%, expressed that the utilization of ChatGPT or similar tools has positively enhanced the quality of their learning, either to a

significant or moderate extent. In contrast, a mere 3% of students indicated a slight downgrade. Notably, none of the participants in the sample selected the option indicating that these tools significantly worsened the quality of their learning, as it is not represented in the figure.

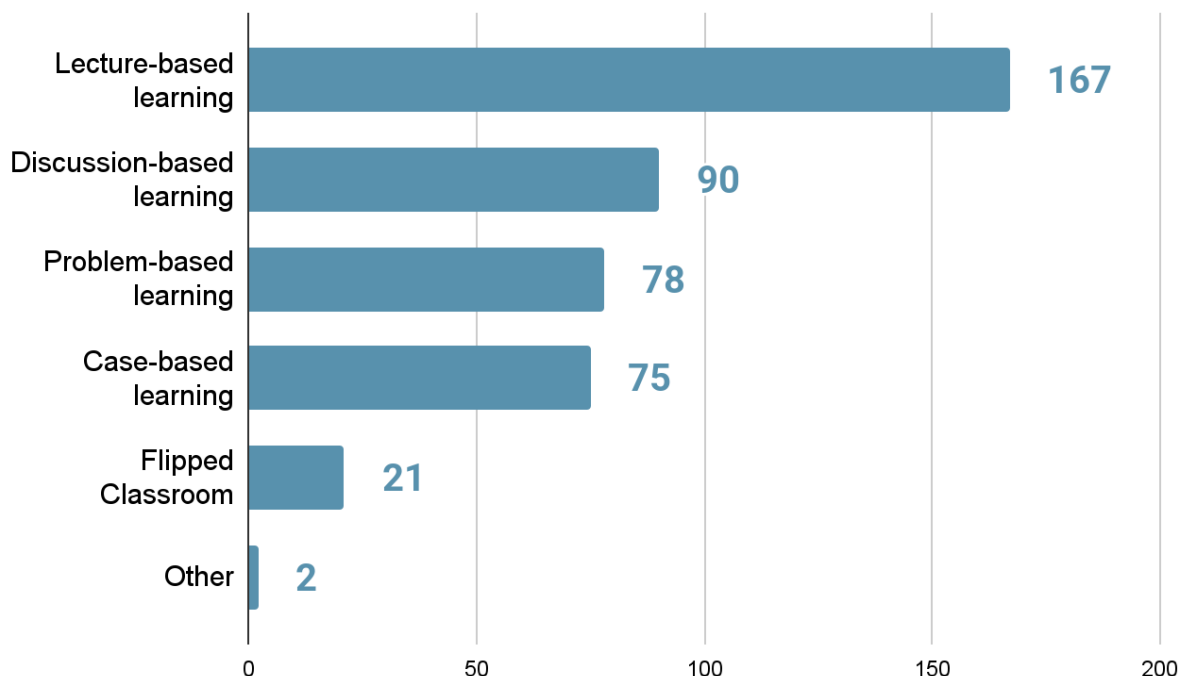


Figure 23: Distribution of teaching methods utilized in students' universities

Students in the sample were also asked about the specific teaching methods employed by their educational institutions. According to Figure 23, Lecture-based learning was the main method used. Practical learning and Project-based learning were also mentioned by some participants.

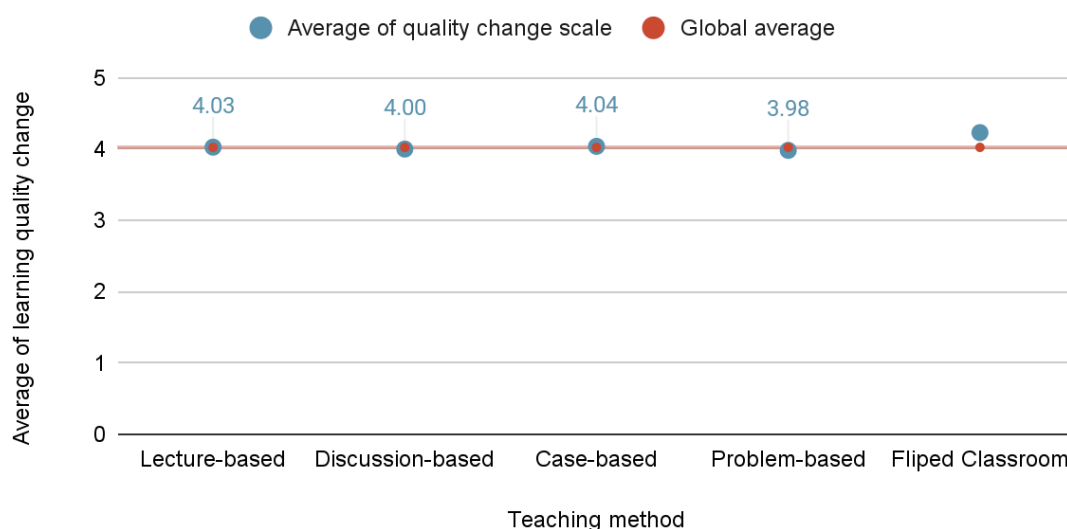


Figure 24: Correlation between teaching method and changes in quality of learning

The survey has also found that all students perceived a general increase in learning quality through the use of LLMs, independent of the teaching method. This suggests a consistent positive perception of students on the learning quality across different methods. The flipped classroom has slightly higher results, which can be due to the fewer answers in this category.

5.4. Feedback and Validation

After data analysis, we shared a summary of some of our findings with professors who participated in interviews for validation of our research. Note that we were not able to provide all the findings for instance some interesting usage and use cases were missing which were later added. Regardless we received following feedback on our findings:

“Most of the information was expected (who was using it and who wasn’t and for what purposes). I had no point of disagreement with any of the findings.”

- Interviewee #3

The professor concurs with one of the important conclusions, which is that universities must adapt to their shift toward student-centered learning.

“This one struck me as vitally important in my field: “The versatility of ChatGPT reflects a shift toward active and student-centered education, generating personalized content, facilitating discussions, and supporting learners in crossing their individual zone of proximal development.” - Interviewee #3

The professor also acknowledged that this specific connection came into their notice through our research and it may change their own teaching strategies to support student-driven learning:

“I am a professor in a school of education with 15 years of experience in schools and classrooms AND I generally work under a sociocultural framework. Although I have definitely considered how this will impact my teaching and assessment practices, I had not explicitly made this important connection. I believe this will be the key to using LLM technologies in education effectively, in framing them as an affordance to student-centered and (more importantly) student-driven learning. It repositions the teacher as the facilitator of learning, rather than the beacon of learning. So many educational institutions position teachers as the center of learning, that is perhaps where the “identity crisis” that teachers are experiencing is rooted.” - Interviewee #3

The professor also mentioned an important point, regarding integration of ChatGPT in the academic writing process, that is to develop new citations and formats to include text generated by LLMs in academia.

“Finally, on a VERY small note, I hope that the APA and other citation and format authorities find a way to attribute sections of work to LLMs. It would ease the use a

great deal in academic circles if we had parameters and ways to cite it.” - Interviewee #3

6. Discussion

This chapter will discuss the data generated by the survey and the interviews with regards to the selected theories and the literature review. The research questions from this project will be answered, beginning with the three sub-questions and then ending with the general research question. Also, the analysis of the interviews has yielded some additional findings, which will be presented as a part of this chapter.

6.1. Current Usage Patterns and Use Cases

Looking at the survey, many different uses of LLMs in education can be found. The data in figure 12 shows that almost 30% of the students use tools like ChatGPT often or always. Then, there are about 35% who use it sometimes and another 35% who use it rarely or never. This data can yield more insights when using Roger's (2010a) theory on diffusion of innovation. According to Roger's theory, there is a normal distribution of adopters in a given group of people or society, as seen in figure 5. Measuring the adopter profiles of the participants of this study, it was found that there is an uneven distribution in the data towards the early adopting profiles, such as innovators, early adopters and early majority. This can be seen in figure 17. As the overwhelming majority of the participants consider themselves open to innovation and being open to adopt these, it is interesting to see that around 70% of the students are using LLMs only sometimes, rarely or never. This slow adoption for a population of open minded and innovation-seeking students suggests that the technology has not yet fully found its place and purpose. It could also hint towards technology-resistant or skeptical students, who consciously limit their use of LLMs or AI in general.

This hypothesis is further corroborated by the data in figure 16 and 18. The former diagram displays that there is less use of LLMs with knowledgeable users, than expected. This suggests that increasing knowledge does not directly translate to increased usage. The latter figure shows the students' usage of LLMs compared to their knowledge, while applying Roger's (2010a) five categories of adopter profiles. The students' usage of LLMs is an almost linear curve that is highest with the innovators and lowest with the laggards. This aligns well with Roger's theory and is expected. However, these results get more interesting when considering the self-reported knowledge on the subject by the participants. The less innovative adopter profiles, especially the laggards, exhibit an unexpected high value in knowledge about this technology. This also suggests that some students are not lagging behind the adoption because of a lack of knowledge or awareness, but because of a deliberate decision to avoid this technology.

Looking closer at the reasons for the technology resistance, one has to further examine figure 15 of the survey analysis. In these questions, participants with poor knowledge and rare use

of LLMs are asked about the reasons for their abstinence from using e.g. Chat GPT. The most dominant reasons were concerns about plagiarism or copyright, over-reliance, or uncertainty and a lack of accuracy, while reasons such as a lack of skill or difficulties of access were not taken half as much. This suggests that there is a significant amount of students who have access, possess skills, awareness and knowledge, but still abstain from using LLMs due to reasons concerning the nature of LLMs, such as the accuracy of information and the danger of over-reliance.

When relating these findings to Roger's framework of diffusion of innovation, this gets more interesting. Roger (2010b, p. 361) finds that such late adopters are usually associated with traditional views and tend to be suspicious of innovations and lagging the awareness of a new idea. When it comes to LLMs and ChatGPT, the results from the survey discussed in the last paragraphs suggest that there are late adopters who cannot be considered the traditional "late majority" or "laggards", to put it in Roger's terms. Rather there are a number of students, who deliberately and consciously avoid this new technology for more educated and personal reasons. Answers from figure 16 demonstrate a deeper understanding of the risks of LLMs, such as the topic of plagiarism or a lack of accuracy.

When it comes to the use cases, the results in figure 14 show a variety of uses. It is noteworthy to mention that multiple answers of the most selected uses are directly related to supporting the learning process in education. Answers such as "research assistance", "essay writing assistance", "test preparation" or "advice and guidance" are all among the most selected and directly benefit the students' learning. These tasks would usually be done by professors and can now be done with technological tools, such as LLMs. This directly relates to connectivism and its principle of learning in non-human applications. Personalized feedback on the research project, essay writing or test preparation is not possible using search engines, wikipedias or books. LLMs are the first technology that takes the connectivist learning principle on such a high level, that it can generate personalized feedback on complex and highly semantic topics. The data from this survey undermines this shift in knowledge-generation of non-human actors, such as LLMs.

Looking at the results from the interviews, the data gives insights about specific use cases of ChatGPT and various ways in which it is utilized by professors and their students in different academic settings. Through the analysis of interview data, four key uses of ChatGPT were identified: Text Generation, Text Analysis, Text Summarizing, and Research Assistant.

In the classroom, professors are employing ChatGPT to generate text for discussions, sample questions, and lectures. It has proven useful in facilitating brainstorming sessions and generating ideas as a starting point for further discussions. Additionally, students are using ChatGPT to summarize longer texts, allowing for more efficient preparation and enabling fruitful discussions.

ChatGPT is also serving as a valuable research assistant for professors. It assists in various tasks, including literature reviews, data analysis, summarizing topics, and preparing training

materials. For example, professors have used ChatGPT to compare literature reviews conducted by their students, to aid in analyzing qualitative data for research studies, and to provide summaries of different subjects, saving valuable time. Furthermore, ChatGPT has proven to be a helpful tool when it comes to writing research papers. Professors have used it to check for errors, conceptual flaws, bias, and generalizations in their writing. It provides valuable feedback and suggestions for improvements, ensuring more accurate and unbiased research papers.

The versatility of ChatGPT extends to language translation, where it has been particularly useful in universities with diverse student populations. As most students don't speak multiple languages, ChatGPT serves as an important translation tool, aiding communication and understanding. Moreover, some professors have found ChatGPT to be a preferable alternative to search engines like Google. Its ability to comprehend complex queries, provide relevant and summarized output, and avoid irrelevant information makes it a valuable resource for addressing specific information needs.

Overall, the findings indicate that ChatGPT is being utilized in a range of academic scenarios, serving as a valuable tool for generating text, assisting in research tasks, aiding in writing processes, supporting translation efforts, and providing reliable and targeted information retrieval. Students use it to aid their learning process, learn new skills, help with homework, assist with research and writing.

The diversity and plurality of uses examined in this chapter underscore the disruptive and substantial effect tools like ChatGPT have in education. LLMs do not only serve a few narrow purposes like calculators or wikipedia, but enable a wide range of uses which penetrate every domain of education. It can be seen that students primarily use LLMs to do tasks, which are traditionally associated with collaborators or professors. These revolve around personalized guidance, feedback and help. Professors on the other hand seem to use LLMs primarily for reasons of efficiency and saving time, such as generating ideas, summaries, and comparing student's work and so on.

These findings reflect a connectivist and social constructivist understanding of learning. Most notably, the connectivist principle, that learning can happen in non-human actors, is corroborated by the findings of this study. Connectivism gives an example for this principle with automatically updating databases (Boyras & Ocak, 2021, p. 1126). This is now significantly surpassed by the capabilities of LLMs. Students replace personal counseling with peers or their professor with ChatGPT and professors generate tasks, or compare students' work more efficiently. These tasks are only possible with machines that have been trained to understand human knowledge, or in other words, who have learned. Therefore this principle of connectivism is more relevant than ever.

Also, the answers provided by students and professors show that this new technology enables a shift in a more active and student-centered direction, e.g. by generating personalized content, translating into the mother tongue, helping facilitate brainstorming sessions and providing starting points for discussions. According to this study, students and teachers are

already leveraging the tools' capabilities to fulfill tasks that otherwise could only be done by humans. The new gain in such a human-like tool has the potential to shift the education in a more student-focused and personalized direction, when used correctly. Teachers seem to already outsource tedious tasks to LLMs, which previously necessitated student assistants. Similarly, the data seems to suggest that some students already fill the gap of a lack of support by professors with LLMs. An example for this could be the lack of personalized scaffolding, which students can now get from ChatGPT, to successfully and repeatedly cross the individual zones of proximal development in their education. This is inline with the social constructivist paradigm, which emphasizes the importance of learner-centered education. The chat-based nature of these tools also match with the constructivist focus on dialogue, language and socially negotiated understanding.

Although connectivism and social constructivism are very helpful theories, it becomes apparent that they are not fully equipped with concepts to analyze education in the new context of intelligent tools, such as ChatGPT. Connectivism touts itself as "A Learning Theory for the Digital Age" (Siemens, 2005, p. 1) and indeed provides helpful tools for assessing learning in a networked environment. It does not, however, account for LLMs such as large language models, who are able to provide the wide array of use cases that are displayed in this section. Therefore this report concludes that an updated theory with this technological disruption in mind would benefit future studies.

To summarize and answer the RQ 1.3, it can be said that LLMs already enjoy a wide adoption in higher education with many different use cases. Although our survey could capture some cautious students, of whom some seem to deliberately avoid the new technology, it can be said that ChatGPT has already reached a wide adoption in higher education. The study finds that LLMs are mostly being used to substitute previously human-intelligence tasks. E.g., students use it to support their learning process and get guidance, while professors use it as intelligent research assistants, who help with efficiency and creativity. The results of this study suggest that this could shift higher education to be more student-centered and student-driven.

6.2. Discipline Specific Effects

Looking at the results from the survey, such as figure 21, there does not seem to be a strong influence of the disciplines of study on the role of LLMs in education. There are small exceptions, such as a higher score for the instructor role in social and health sciences, but generally there is a consistent cross-discipline trend that goes towards using them as an intelligent collaborator, followed by feedback provider and instructor.

The results from the interviews shed another light on this topic. According to the professors, writing in different disciplines has its own distinct meanings, norms, and rules, necessitating different strategies for incorporating ChatGPT as a writing tool. Disciplines that place a greater emphasis on written work are more significantly affected by ChatGPT, such as Social Sciences compared to physics or chemistry. This is related to the dynamics of plagiarism. As

mentioned by interviewees, disciplines such as social sciences and humanities are strongly affected in students' assessment compared to e.g. STEM fields as they are less about writing. More specifically, in computer science, it has been seen that students no longer utilize geeksforgeeks, stackoverflow, or kaggle to solve debugging problems or comprehend specific code; instead, they just create a prompt in chatGPT to produce the code, then copy it and paste it. To account for this, there are attempts to integrate ChatGPT into assignments by acknowledging its use and adopting discipline-specific approaches.

The adoption of ChatGPT is also reshaping practices within the discipline of information literacy. There is a growing focus on teaching information literacy especially in the context of citations due to the absence of an authoritative voice in ChatGPT-generated content unlike a human author with academic credentials and reputation. This includes discussions about the author's context, such as their time, place, gender identity, and intersectionality, which are crucial elements in academic research.

Answering the RQ 1.2, it can be said that discipline specific effects have been found by this research project. While the students generally report a consistent trend in using LLMs as collaborators, the professors and experts interviewed have a more nuanced and ambiguous opinion on this. The interviews suggest that each discipline has different requirements in writing, assessment and plagiarism, which poses different challenges and considerations in each of them. E.g. disciplines like humanities or social sciences need different responses compared to Chemistry or Physics. Next to the need for a general AI strategy in education, this study suggests that for an effective integration of LLMs into education, discipline-specific approaches are required to deal with the individual challenges.

6.3. Change in Quality of Learning and Teaching

The results from the survey, such as in figure 22, show that over 80% of students believe that LLMs improve their learning quality somewhat or significantly, while only 4% report that the quality has worsened. This effect is also equally stable, when comparing the results across different teaching methods, as visible in figure 24. The positive evaluation of the students can be explained with the many tasks this new technology can fulfill. On the one hand, according to the findings of the next section and in line with connectivism, LLMs are a very comprehensive and intelligent new source of information in the network of the learner. Not only is it able to substitute other sources of information, such as search engines, books, wikis, etc., but it can synthesize information in new ways that fit the learner's intention, such as generating a tailored report about a topic. As LLMs are trained on virtually the whole internet, they can also act as a gateway to more and previously unreachable information sources, as they can infer the users intention from the prompt without the special vocabulary - a feature that search engines still lack. This makes LLMs a much more effective searching tool. Also, analyzing with social constructivism, LLMs harbor the potential to provide individual and the right scaffolding for each learner to progress through their current zone of proximal development (ZPD). As professors often have dozens if not hundreds of students in their classes, they are virtually not able to account for each learner's individual ZPD and

scaffolding needs. LLMs such as ChatGPT therefore constitute a powerful tool, which is able to account for this gap. Students are able to self-support themselves efficiently when falling behind, which would be significantly more difficult with static information sources, such as books or learning material. The results of the survey support this claim: Asking for the use cases of students, three out of the first five answers revolve around helping the students to learn.

However, the optimism and appreciation of the students should be understood with caution. This new tool makes many steps in the learning process easier, but not necessarily better in quality. Therefore students could be tempted to welcome this improved efficiency, while not accounting for the new loss in quality. Not all students might be aware of the risks and faults of LLMs and hold the necessary AI-literacy to account for that.

The research findings of interviews conducted in our study suggest that it is too early to determine the long-term effects of ChatGPT on education. The opinions of the interviewees vary, with a combination of optimism and caution. More optimistic participants believe ChatGPT could lead to improved learning by automating tasks and facilitating higher-level understanding. Conversely, some interviewees expressed concerns about the potential decline in learning quality. They highlighted instances where students rely on ChatGPT for assessments, resulting in less sophisticated and off-topic responses. Another worry is that ChatGPT may produce content that does not adhere to scientific methods, thus compromising the quality of scientific writing. Therefore, the appropriate and responsible utilization of these technologies remains uncertain.

Interviewees emphasized the importance of integrating ChatGPT into education and teaching students critical evaluation skills. They advocated for a deeper understanding of AI's role in learning, encouraging students to analyze content and make informed decisions about when and how to use ChatGPT effectively. Furthermore, human supervision and critical thinking were emphasized as essential in evaluating AI-generated content and distinguishing between real and artificially generated information. Additionally, the teachers who presently use flipped classrooms and problem-based learning models are adamant that ChatGPT and related tools will enhance the quality of instruction and, as a result, aid students in learning more effectively. An efficient method of teaching is through emphasizing problem-based learning, which focuses on developing skills to identify, solve, and overcome one's biases during problem solving. These findings are in line with the paradigm of social constructivism, which posits that the process of learning is more important than the content itself (Mattar, 2018). Critical thinking and other methods of reflecting one's learning behavior is a common technique in constructivist learning and might increase in necessity, as the nature of LLMs biases and hallucination cast doubt on the credibility of generated information. This is also in line with Lai's (2011) call for a focus on lifelong learning in education, which prioritizes learners' ability to adapt to changing contexts and tools, assess information, engage in metacognition and improve in problem solving.

In conclusion, the research findings present ambiguous perspectives on how LLMs impact the quality of education. An overwhelming majority of students seems to appreciate the new tool, as it can aid them in the learning process in many new and disruptive ways. The interviewed professors seem to be more careful and nuanced in their responses. Some are optimistic, others express concerns about learning quality and emphasize the need for human oversight. Therefore RQ 1.3 cannot be answered clearly. The study suggests that LLMs simultaneously have the potential to improve the quality of education in some aspects and especially students seem to appreciate this tool. Conversely, it is also reducing the quality in other aspects. Therefore it can be said that only when the risks and negative effects of LLMs are properly accounted for, e.g. through focusing the curricula more on AI literacy and lifelong learning, can it be said that this new technology will generally improve education.

6.4. Overall Influence on Learning and Teaching in Higher Education

This section begins by assessing the current influence of education. Afterwards, the potential future developments will be discussed. When assessing the influence of LLMs on learning and teaching in higher education, it makes sense to start off with the already changing patterns in usage of students and professors. The previous section has found that ChatGPT, and other LLMs, are already strongly affecting higher education in many different ways. For example the use of ChatGPT within educational institutions mainly as writing substitute (Herman, 2022), and in certain cases, such as in NYC Public Education, it has even been prohibited (Ropek, 2023b). Over half of all students of the survey are already using this tool for e.g. helping them learn and substituting professors and collaborators guidance, suggesting a constructivist and connectivist use that supports learner-agency. While there are a number of students, who seem to deliberately abstain from using LLMs because of doubts, the diverse use cases show that LLMs have already reached many integral parts of the student's learning process.

Also the professors report intense usage and are able to achieve higher levels of efficiency, creativity and personalisation in their academic and pedagogical work. LLMs seem to function as a general assistant, being able to do various tasks related to the preparation and assessing the teaching work and some professors are already including it inside the lessons themselves. The data shows that LLMs are primarily being used for tasks, which were previously done by humans. This shift from human intelligence towards artificial intelligence in higher education seems to be finally cemented with the release of LLMs. The data of this study records some of its wide-ranging effects. One of them is the quality of learning and teaching.

Inquiring about the quality of education in this study has led to ambiguous results. While most students agree that it has improved their learning quality, the long term effects remain to be seen. Professors equally see risks, such as a loss in accuracy, plagiarism or the adherence to scientific methods, and opportunities, such as improved efficiency, personalisation and

more student-centered learning. A clear direction for the change of quality cannot be found by this study. Rather, the data suggests that LLMs hold the potential to worsen or improve the general quality of higher education, depending on how they are going to be integrated into educational practices. This points towards the need for the right institutional and regulatory response, to guide LLMs into the right direction. This is further intensified, as this study reports varying needs and effects of different disciplines in higher education. As LLMs are able to write texts, code or law paragraphs, answer general knowledge questions and have a degree of mathematical capabilities, every discipline is affected in different ways.

Concluding the influence of LLMs on education until now, it can be said that LLMs have had a strong and disruptive effect, upending traditional teaching practices and changing the way students learn and professors teach. Its quick adoption and powerful capabilities hint at a major transformation of education, which is already going on. Indeed, the professors of this study speak of strong changes in classrooms, an evolving understanding of learning and a shift of the role of the teacher. How is this transformation going to play out? And how will LLMs influence higher education in the long term? It is hard to predict which direction this transformation will go. Many of the interviewees spoke of the unpredictability and uncertainty in this process. Nevertheless, when consulting the literature and theories on this subject, one might get more insights to answer this question.

Looking at the theories and the literature review, it can be found that a paradigm shift has been happening in the last decades, which redefines how we understand learning and teaching. Education is slowly moving from a behaviorist and teacher-centered paradigm towards the more constructivist and student-centered paradigm, which has many implications. Learning has evolved from the simple consumption and reproduction of knowledge towards concepts such as knowledge-construction, metacognition, social learning and empowering the learner. Similarly teaching has evolved from a standardized mass-transaction of knowledge to facilitating the learning process with active and authentic tasks, fostering collaboration and reflection. Inside this ongoing paradigm shift, AI and specifically LLMs are now heavily disrupting educational practices and increasing the pressure on education.

Ouyang and Jiao (2021) have developed a framework of three paradigms of AI Education and demonstrate the different directions in which AI could shape education. The first paradigm “AI-Directed, Learner-as-Recipient” represents the behaviorist paradigm and leaves little agency to the learner. The second is called “AI-Supported, Learner-as-Collaborator” and sees a mutual relationship between the learner and the AI. This paradigm is underpinned by social constructivism and is more student-centered. Lastly, the third paradigm “AI-Empowered, Learner-as-Leader” rather reflects the whole ecosystem of education, including multiple learners, instructors, other information and technology. It is founded in connectivism and complex adaptive systems and has the highest level of learner-focus and agency.

As previously discussed, the effects of AI depends on our reaction and integration into education. This in turn heavily depends upon the underlying paradigms, which shape the debate, opinions and further actions. Using Ouyang and Jiao’s framework, this study suggests

that the current understanding comes closest to “AI-Supported, Learner-As-Collaborator”. Figures 14, 19 and 20, as well as the responses from the professors, such as in section 5.2.2 show how LLMs are being used predominantly as an intelligent collaborator. It can be found that data generated by this study reflects the greater paradigm shift towards a constructivist and student-centered understanding of education. Students and teachers show usage and opinions, which emphasize student-centered learning, lifelong learning and augmented human intelligence - all of which fall into the second or even third of Ouyang and Jiao’s paradigms.

Interestingly, Ouyang and Jiao agree with this, stating that the debate is “currently moving towards Paradigm Three AI-empowered, learner-as-leader to facilitate learner agency, empowerment, and personalization, enable learners to reflect on learning and inform AI systems to adapt accordingly, and lead to an iterative development of the learner-centered learning” (Ouyang & Jiao, 2021, p. 5). Looking at this development with a constructivist and connectivist understanding of education, this seems to be a welcomed development.

To summarize, it cannot be predicted how the transformation, kickstarted by LLMs, will play out. Taking the bigger context into account, it can be found that the general and ongoing paradigm shift towards a constructivist and learner-centered understanding of education reproduces inside the debate on the adoption of AI and LLMs into education, suggesting an integration of LLMs that augments humans rather than replacing it.

6.5. Other Insights and Recommendations

Besides addressing the three primary research questions, several important discussions emerged from interviews with professors. Beyond the physical confines of the four walls, the traditional classroom structure has changed. Students in the twenty-first century don't have to rely only on their instructors thanks to the extensive instructional materials that are now available online and the move to remote learning. With the focus on the future of AI in education, the disruptive nature of LLMs, and ChatGPT in particular, was highlighted, emphasizing the need for universities to shift from banning such technologies to designing policies that integrate them into the curriculum.

At the same time, many teachers emphasized the importance of developing a collaborative relationship with this technology to improve learning outcomes, and recognised ChatGPT as another valuable tool in their teaching toolbox. One intriguing issue that came up during the interviews was the need for professors to reevaluate the structure and grading of assignments, shifting away from a focus on mandating that students write lengthy 1000-word essays on a given topic in favor of fostering critical learning and understanding argumentation. One respondent made a comment that if ChatGPT makes it simple to complete the assignments teachers provide in class, the assignments themselves need to be redesigned.

They also acknowledged the challenges universities face in accessing resources, particularly the student/teacher ratio for eg. 1:500 in a university where one of the interviewees taught,

which makes it difficult for every student to have direct access to professors, who are often spread thin. Therefore, having a tool such as ChatGPT to hand can assist students to clarify basic doubts and gain a better understanding of certain topics.

In addition, teachers recognised that while ChatGPT has the potential to disrupt education, it also has the potential to exacerbate the digital divide, leading to the emergence of an "AI divide". In order to bridge this gap and ensure equal access to education, it is crucial for teachers to familiarize themselves with the technology and develop AI literacy. Many professors concurred that in order to use AI effectively and to advance equitable educational opportunities for everyone, educators themselves must possess a certain level of AI literacy. Also over-reliance on AI tools can hinder learning, emphasizing the need for critical analysis and effective use. Collaboration between humans and AI should prioritize human control and creativity. AI literacy is essential for students and requires humans to sit on top of AI. Balancing AI's roles with human thinking is key.

In conclusion, the teachers' perspective on LLMs, particularly ChatGPT, reveals a clear indication of optimism and enthusiasm, coupled with valid critical concerns.

7. Limitations

The research study is conducted at a stage when ChatGPT is relatively a new phenomenon for academia. The study's early stage in academia and the newness of the research area contribute to limitations in terms of available literature, established frameworks, and empirical evidence. This scarcity of resources hampers the ability to make comprehensive comparisons, validate findings, and build upon existing theories.

Additionally, due to the researchers' affiliation with AAU University Copenhagen, there is a notable concentration of survey participants from Denmark. It is important to acknowledge a potential bias that may limit the representation of perspectives from individuals in non-developed countries, potentially overlooking the impact of the digital divide on LLM adoption. This bias arises due to the researchers' relatively easier access to students in developed countries compared to other regions. Caution should be exercised when generalizing the findings to a broader global context, and future research should strive to include participants from diverse socio-economic contexts to gain a more comprehensive understanding. The prevalence of the 18-24 age group in the sample also indicates a significant presence of young adults in the study. This can be attributed to the targeted focus on higher education students. Hence, this limitation should be acknowledged, as it may impact the generalizability of the results to the broader population.

The choice of interview subjects was mostly based on accessibility, although two academics who were familiar with the researchers and eager to contribute were also taken into consideration. The interviewees were also chosen for the interview based on their individual interest in ChatGPT and related technologies; several of them also run podcasts and publish

articles on the subject. There were also technical difficulties with the software for transcription during the online interviews. The interviews lasted between 20 and 32 minutes since both sides were pressed for time. It would have been beneficial to extend the interviews' length to allow for a deeper examination of the topic matter in order to acquire more thorough insights. Due to limitations in time and the researcher's limited contacts, our study was unable to include interviews with professors from various disciplines, such as medicine and law, as originally intended which may result in a narrower perspective and potentially exclude insights from other academic disciplines. Moreover interviews were primarily focused on education within the English language context which limits the inclusion of insights from non-English language systems. This linguistic limitation hinders the generalizability of the findings beyond English-speaking educational contexts. Additionally, the study's geographical limitations, such as the exclusion of regions like China, Africa or South America, restrict the representation of cross-cultural perspectives and experiences from those regions.

Acknowledging these limitations is essential to ensure a balanced interpretation of the research findings and to guide future studies in addressing these gaps. It highlights the need for further research and exploration in the field to provide a more comprehensive understanding of the topic under investigation.

8. Conclusion

Since the advent of ICTs and later AI technologies, higher education has seen numerous transformations. At the moment, Large Language Models (LLMs) are gaining ground in the educational field. The focus of this study, through surveys and interviews with students and professors respectively, is to analyze how LLMs are influencing teaching and learning in higher education.

This study has found that many students have adopted this technology and see an improved quality in their learning. They are seeking support in LLMs that is traditionally associated with teachers' responsibilities, such as writing assistance, test preparation and research guidance. However, some students are also skeptical about using such LLMs in their education because of hallucinations, bias and plagiarism. This study suggests that there is a group of students who consciously abstain from using LLMs, because of their educated doubts. From a teacher's point of view, the study shows how teachers are using LLMs best described as intelligent assistants, e.g. to facilitate brainstorming sessions, automate redundant tasks and generate new ideas. Some educators are apprehensive of using it in the classroom because it is such an emerging technology. Additionally, reviewed literature suggests the existence of many other potential applications that can bring benefits to both teachers and students in their educational journey.

While some academics may not fully appreciate the transformative impact of AI, LLMs are progressively finding their place in higher education across various disciplines, including

journalism, medical sciences, engineering, humanities, and more. It has also been shown that these tools have a significant impact on teachers and students in disciplines such as the social sciences, where there is a greater emphasis on written work. Whereas in STEM, students rely on these tools to code, understand challenging and complex subjects, and to develop innovative project ideas. The study shows that professors are aware that each subject has different criteria for writing, assessment and plagiarism. These criteria present different difficulties and factors to consider. For example, humanities and social sciences require different responses than chemistry or physics. Therefore, there is a need for universities to have policies in place that take all these factors into account.

This study finds ambiguous results on the affected quality of education. The overwhelming majority of students report an increased quality of learning and over half of students are using it already. The professors voiced both hope and cautions: While it can lead to more efficient procedures and opportunities for student-centered teaching, also professors need to change the way they design assignments and assessments for students and it can lead to a less scientific quality of results. It is described how the role of professors shifts from being the gateway of information towards becoming the facilitator of it. These developments require an increased focus on digital literacy and AI literacy and an active incorporation of LLMs into the curriculum.

To conclude, LLMs in education can best be described as a major disruptor and its long term effects remain uncertain. However, it has been found that the general paradigm shift towards a constructivist and learner-centered understanding of education reproduces inside the debate on the adoption of LLMs into education. This led to students using the gained agency to support individual learning while professors use it to foster discussion and brainstorming. This study suggests a future integration of LLMs into education that could augment human intelligence rather than replacing it.

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10. Appendices

10.1. Appendix A - Methodology

10.1.1. Literature Review Cycle

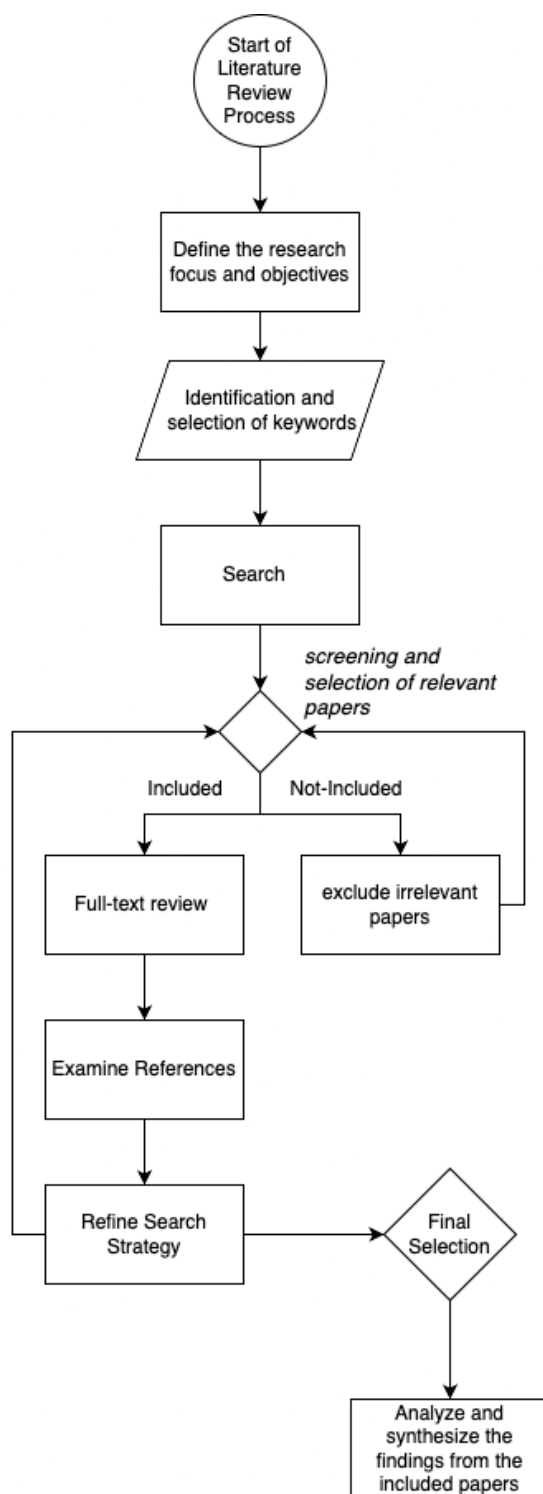


Figure A1: Iterative Process of Selection of Literature

10.1.2. Mixed Methods

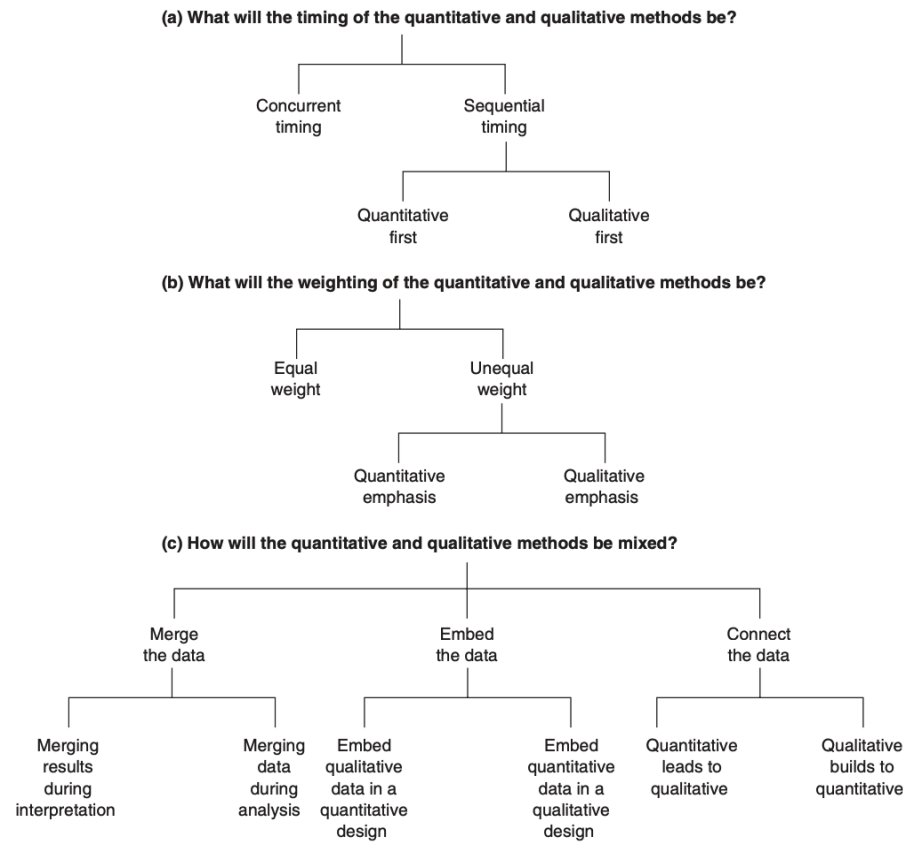


Figure A2: The Decision Tree for Mixed Methods Design Criteria determines the appropriate timing, weighting, and mixing of the quantitative and qualitative components in a mixed methods study (Creswell & Clark, 2017)

10.1.3. Sampling Diagram

Matrix Crossing Type of Sampling Scheme by Research Approach

Qualitative Component(s)			
Quantitative Component(s)		Random Sampling	Non-Random Sampling
	Random Sampling	Rare Combination (Type 1)	Occasional Combination (Type 2)
	Non-Random Sampling	Very Rare Combination (Type 3)	Frequent Combination (Type 4)

Figure A3: A matrix that intersects the type of sampling method (random or non-random) with the research approach (qualitative or quantitative) (Onwuegbuzie & Collins, 2007).

10.2. Appendix B - Survey

10.2.1. Formation of Survey Questions

Question 1 - How is your knowledge regarding ChatGPT (or similar tools)?

The first question was designed as a single-answer question with five predefined options based on the Likert scale:

Very Good	Good	Fair	Poor	Very Poor
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Question 2 - How often do you use ChatGPT (or similar tools) in your studies?

The second question was defined as a single-answer question with five predefined options based on the Linkert scale:

Always	Often	Sometimes	Rarely	Never
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Question 3 - What are the reasons preventing you from using ChatGPT (or similar tools) in your studies?

This question was designed as a multiple-choice question with the below eight predetermined answers, which were derived from the literature by Kasneci et al. (2023), Dwivedi et al. (2023), D'Amico et al. (2023), Atlas (2023), and Zhai (2022). Additionally, respondents were given the option to provide their own answers.

- Plagiarism and copyright concerns
- To avoid over-reliance
- Privacy and data security concerns
- Societal biases and discriminations
- Uncertainty and lack of accuracy
- Lack of human-alike interaction
- Access difficulties
- Lack of skill

Question 4 - For which purposes do you use ChatGPT (or similar tools) in your studies?

The next question was formulated as a multiple-choice question with the below nine predefined options, which were derived from the findings of the literature by Dwivedi et al. (2023), Kasneci et al. (2023), Rospigliosi (2023), and Neumann et al. (2023). Respondents were also given the opportunity to provide their own answers.

- Homework help and assignments
- Essay writing assistance
- Test preparation
- Research assistance

- Learning new skills and general knowledge
- Advice and guidance
- Mental health support and counseling
- Personal development and growth
- Time management and organization

Question 5 - How has using ChatGPT (or similar tools) affected the quality of your learning?

This question was structured as a single-answer question utilizing a 5-point Likert scale, offering respondents five predefined answer options.

Improved significantly	Improved somewhat	No change	Worsened somewhat	Worsened significantly
------------------------	-------------------	-----------	-------------------	------------------------

Question 6 - What roles does ChatGPT (or similar tool) fulfill for you in your studies?

This question was designed as a multiple-choice question with three predetermined answers, which can be seen below and were formulated based on a combination of relevant findings from the literature review, particularly from the texts by Hwang et al. (2020) and Ouyang and Jiao (2021). Additionally, participants were provided with the option to include their own answers to ensure a comprehensive range of responses.

Instructor	Intelligent Collaborator	Feedback Provider
------------	--------------------------	-------------------

To enhance the comprehension of these concepts for the general sample of students, definitions were provided for each role:

- Instructor: Designing and developing instructional materials that align with learning objectives and provide students with opportunities to practice and apply their knowledge and skills.
- Intelligent Collaborator: Helping learners with problem-solving tasks, ideation and brain-storming, engaging in collaborative work.
- Feedback Provider: Evaluating student performance using a variety of assessment methods and providing feedback on areas for improvement.

Question 7 - How comfortable are you with adopting ChatGPT (or similar tools) as a new technology in your studies?

The seventh question was formulated as a single-answer question with five predefined options, aligning with the definitions of the five profiles outlined by the Diffusion of Innovation theory when adopting a new technology:

- I actively seek out and enjoy using new technologies in my studies (*Innovators*)
- I am comfortable using new technologies in my studies, but prefer to stick with tools and platforms that are familiar to me (*Early adopters*)

- I am willing to try new technologies if they are recommended by my instructors or peers, but I can feel intimidated by unfamiliar technology (*Early majority*)
- I am hesitant to use new technologies in my studies, and usually require a lot of guidance and support to feel comfortable (*Late majority*)
- I am resistant to using new technologies in my studies, and prefer to rely on traditional methods of learning and communication (*Laggards*)

Question 8 - Which teaching method is being used in your university?

This question was defined as a multiple-choice question with five options, which were selected from the categorization of different teaching methods by Sivarajah et al. (2019) and Westwood (2008). Additionally, respondents were given the opportunity to provide their own answers to ensure inclusivity and account for any additional teaching methods not listed.

Lecture-based learning	Discussion-based learning	Case-based learning	Problem-based learning	Flipped Classroom
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Question 9 - How do you identify yourself?

Students were asked to identify their gender in this question.

Male	Female	Other	Prefer not to say
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Question 10 - What is your discipline of study?

This question is a single-choice question with eight answers based on the categorization of different disciplines of study, allowing students the option to add their own answers.

- Business and Management
- Engineering and Technology
- Health Sciences
- Humanities
- Natural Sciences
- Social Sciences
- Education
- Fine Arts and Design

Question 11 - What country are you studying in?

This was a single-choice question with 196 country choices to collect demographic data from the sample of students.

Question 12 - How old are you?

Lastly, students' age was collected through a single-choice question with seven options.

Under 18	18-24	25-34	35-44	45-54	55-64	Above 64
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10.3. Appendix C - Interviews

10.3.1. Interview Guide

Interviewee: _____
Designation: _____
Organization: _____
Discipline: _____

Interviewer: _____
Contact: _____
Date: _____

Introduction

- Thank you for agreeing to participate in this research interview.
- The purpose of this interview is to gather your perspectives on the role of LLMs (ChatGPT) in learning and teaching in higher education.
- Interview will take approximately 30 min.
- Interviews will be conducted via Microsoft Teams (meeting link will be sent via email).
- Interviews will be recorded (both audio and video) for transcription and data analysis.
- **Disclaimer:** We use ChatGPT as a proxy also for other Large Language Models (LLMs), e.g. like Google Bard, Facebook LLaMA and OpenAI's GPT-4. If you have used any of those, the questions apply.

Interview Questions

Background

1. Could you briefly introduce yourself, your experience and courses you teach?

Usage

2. Have you used ChatGPT before? If yes, how? If no, why not?
3. Have you encouraged your students to use ChatGPT? If yes, how? If no, why not?

Role

4. What is your current perception of the role of ChatGPT in higher education? Why?
5. Where do you see the future role of ChatGPT (and other LLMs) in higher education?
 - 5.1. Follow up: Why? How do you see it for learning and teaching?
6. What role(s) does ChatGPT play in your discipline of study?
 - 6.1. If expert: Do you believe that ChatGPT plays different roles based on the discipline of study?
7. What role(s) does ChatGPT play in your method of teaching?

Quality

8. Does ChatGPT already affect the quality of learning and teaching? How?
9. How do you expect ChatGPT will affect the quality of learning and teaching in the future?

Concluding Remarks

10. Is there anything else you would like to add or discuss before we conclude the interview?

10.3.2. Description of Interview Respondents

Interviewee	Discipline	Position in University	Country	Duration of Interview
1	Social Sciences	Professor/ Head of Social Science Dept	Austria	20 minutes
2	Political Science	Associate Professor	United Arab Emirates	32 minutes
3	Curriculum and Education	Professor	Pakistan	32 minutes
4	AI and NLP	Associate Professor	India	20 minutes
5	Entrepreneurship and social entrepreneurship	Associate Professor	Pakistan	25 minutes
6	Pedagogy and Education	Affiliate Associate Professor	Canada/Denmark	26 minutes
7	Education	Associate Professor (PhD in progress)	USA	32 minutes

Table C1: Description of Interview respondents

10.3.3. Codebook for Thematic Analysis of Interviews

#	Code	Description
1	Text Generation	The process of generating human-like text using LLMs.
2	Text Analysis	The process of extracting meaningful insights, patterns, and information from textual data using LLMs.
3	Text Summarizing	Using LLMs to condense text into a shorter version while retaining the key information and main ideas.
4	Research Assistant	LLMs to support and assist in research activities, including data collection, analysis, literature review, and administrative tasks.
5	Improve	Increase quality of learning and teaching using LLMs.

6	Decline	Decrease quality of learning and teaching because of use of LLMs.
7	Human Touch	Human supervision of LLMs.
8	Discipline	Field of study for a specific subject area, in context of LLMs influence.
9	Classroom	LLMs influence in physical or virtual space where teaching and learning take place.
10	Teacher-Student Ratio	The proportion or number of teachers to students in an educational setting.
11	Personalization	Tailoring or adapting learning experience to meet individual needs, preferences, or characteristics of students.
12	Assignment	A task, project, or piece of work given to students by a teacher to complete.
13	Assessment	The process of evaluating or measuring knowledge, skills, abilities, or performance.
14	Grading	Assigning scores, marks, or evaluations to assess the quality of student work.
15	Plagiarism	Presenting someone else's ideas, work, or words as one's own without proper attribution or acknowledgment.
16	Copy-Paste	The action of duplicating or transferring content from LLMs by copying and pasting.
17	Bias	The tendency of LLMs to reflect and potentially amplify biases present in the training data, resulting in unfair or discriminatory outputs.
18	Prompt Engineering	The deliberate design of instructions to get desired responses from LLMs.
19	Teach teachers	Training teachers to use and incorporate LLMs in their teaching practices.
20	AI Awareness	Consciousness or knowledge about AI in educational settings
21	AI Ethics	The ethical considerations, principles, and guidelines related to artificial intelligence.
22	Guidelines	Recommendations, instructions, or standards for setting direction for LLMs.
23	Ban	The prohibition or restriction imposed on use of LLMs by

		universities and institutions.
24	Inequity	Unfairness or lack of equality in context of usage and adoption of LLMs.
25	AI Divide	The gap in access to and use of LLMs between students with different capabilities.
26	Disruptor	LLMs as an agent for significant changes or disturbances challenging existing practices.

Table C2: Codebook for Thematic Analysis of Interviews

10.3.4. Transcripts of Interviews

Interview #1 - Transcript

Interviewer [00:00:07] Could you briefly introduce yourself and also tell about your experience and what courses you teach?

Interviewee #1 [00:00:17] I'm [Professor's Name]. I'm a professor at [University Name]. I'm teaching media policy and media economics, and I have professional experience of over 20 years.

Interviewer [00:00:32] Have you used ChatGPT before or have you heard about it?

Interviewee #1 [00:00:40] Both. I have heard about it and I've used it. I've used it in particular, because I'm curious and wanted to see what the potential of ChatGPT is and what AI in the framework of text analysis can do. And I have been using it myself, for example, I tried to ask GPT to tell me a fairy tale for my grandchildren and the result was pretty creative. It was better than expected and I've used it also in professional contexts, used it in teaching and using it for my own writing, so I have some experience, but not much.

Interviewer [00:01:28] You said you have been using it in teaching, so have you been using it for scheduling your classes or for anything specific that you can recall?

Interviewee #1 [00:01:40] Yes, I was using it for literature reviews. I asked my students to do literature reviews themselves and asked ChatGPT to do literature reviews, and then we compared those. This was one application where we used ChatGPT and then we also checked how well it can write new texts. So we compared those human writings for scientific texts and machine writing of scientific texts, which was pretty disastrous because ChatGPT invents things which is not exactly a scientific method. So it was a certain kind of frustrating experience, but it was obvious that there is a lot of potential there.

Interviewer [00:02:29] Have you also encouraged your students to use ChatGPT in your specific class or experiment with that?

Interviewee #1 [00:02:38] Yes. My position or my understanding of ChatGPT is that this is a technology which is not going away again. So this is something which will be part of our daily life both in the private context as well as in the professional context and also in the scientific context. So it

is my intention to prepare together with the students for this kind of next step into the future where we will have the assistance of AI based systems in teaching and in publishing as well as in organizing our work and the earlier we make our experience the better for all of us. So my intention is to bring this technology into the classroom. So the students have an opportunity to learn and to see where they can use it, where it makes sense for them and where it doesn't so that we can have a learning process to see how this technology can assist or can also hamper or prevent our scientific process.

Interviewer [00:03:49] It's interesting to understand your perspective because a lot of professors and universities have banned it and have stopped students from using it. But do you have any suggestions or comments on that part?

Interviewee #1 [00:04:04] I know that this is a highly controversial debate, in particular when it comes to exam writing or essay writing in a scientific context, at least in social sciences. And there we have of course an issue if texts are not written by students, but ChatGPT, but this is a fact of life. So we are going to have this technology at hand. At the time when calculators were invented. Some professors said, well, this is going to be the end of the brain because the brain doesn't know how to calculate $3 + 5$ anymore, so I think it's a similar situation. We need to learn how to make best use of it. Also in scientific work there is a lot of routine work which could be done by machines and should be done by machines. So I'm much less skeptical than others. But there are indeed issues when it comes to exams and there we will have to find solutions and one of the solutions we are at least it's not the solution, it's a quick fix actually is that we change from written exams again to oral exams because there you can see how competent students are when they express themselves orally. So in that sense there are ways of progress or ways of living together and having a better scientific life with ChatGPT than before without.

Interviewer [00:05:41] When you said how you are experimenting in your class, do you also think that there should be AI literacy also for the professors in order to use this new technology in their classrooms and also with your discipline social sciences, do you think this technology will play a good role or a in what way it can play a role?

Interviewee #1 [00:06:07] First of all, yes, I think it's important that the teachers learn how to use the instrument and this is not a given, and depending on which topic you're working on, some professors might be more advanced than others. But in general, teaching teachers is a fundamental principle when you have any kind of new development there. So yes, I think this is important. And the second question was?

Interviewer [00:06:39] The question was do you think it will affect your particular discipline, which is social sciences?

Interviewee #1 [00:06:46] Yes, definitely because as far as we can see now and this is, I think it's only the beginning because there are so many applications out there and ChatGPT is just one among others. And others are creating pictures or other technologies creating music, and there is a lot of new development going on and we can't see now already very clear where it's good, where it's going. But all of this or if not most of them, maybe all of them are going to affect social sciences in its core competence, which is dealing with texts first of all. Secondly, managing large amounts of data which is in some of our social sciences, very important thing if you think about for example, for election campaigning for example and polling all that creates a lot of data and they are AI based systems in general can play a very important role to help us with better analyzed data, see patterns in these data which we cannot see if we do it manually. So in that sense, yes, I think that not only sciences, but also

social sciences are deeply affected by AI technology.

Interviewer [00:08:05] Just to follow up, because as a student in your class your teaching method is quite different. So is it different for all the classes you conduct and do you think with the method of teaching that you have this technology ChatGPT can play a role in having better student professor interaction?

Interviewee #1 [00:08:29] Well, this is maybe an area where ChatGPT plays less of a role because as you have experienced yourself my teaching is basically based on talking and on interaction between humans and to prepare that kind of interactions of course this is of interest, so we might in the future for example have a larger syllabus of literature because students can ask AI based technology to make short versions of texts of longer texts, so we can have a discussion or we can we can have more texts to be prepared for our lectures. But teaching in person, which means in the classroom with interaction between professors and students. This I think is the least affected area of my scientific teaching and writing and scientific work then any other area I think.

Interviewer [00:09:31] You talked about how human interaction is more important in this teaching and learning process, right? So do you think with all these available technologies it would replace the kind of role the teachers provide? Also as a mentor to the students because then the students won't reach out to the professor, they will just go online and, you know, ask such computers for answers.

Interviewee #1 [00:09:59] Well, there are various facets to this problem or to this issue. One is that some of our studies still have many more students than professors. So if I think of my own university or University of Vienna for example, where there are, say, 10 professors for 5000 students then in an AI based system giving answers might be a help to students who would not have any way, would not have access to professors because there are too many students and too few professors, so that that might help them. However, I'm doubtful whether the veracity in particular of ChatGPT can be improved to a level where we can trust this instrument. As of now, it's not, so this is a major problem, but that might be solved in a couple of years. Let's see. So yes, there might be, for some studies where students would not have a chance to contact professors. There might be better options than before, but in the regular and normal contact between students and professors, I think that the personal contact still is a way of better, more flexible reaction to the issues and problems and questions students have if this is done in person.

Interviewer [00:11:36] You also talked about how when calculators and computers were launched, it changed the way teaching was done. And you have actually witnessed all of that. So do you think this new technology, which is ChatGPT and other Google Bard, etc. which are getting launched nowadays, will actually impact teaching and affect the quality of learning and teaching?

Interviewee #1 [00:11:59] As an optimist. I do believe that this is going to improve learning and teaching, so results can be seen earlier and faster. I think learning can be enhanced by these technologies if we use them wisely and this of course is the critical issue. We don't know yet really in detail what wisely would mean, but we can see that for some of the routine things where you try to learn, derive the answers to sophisticated questions there ChatGPT might help if you train the algorithm in a way that students get the right answers and the correct answers rather than answers which are just composed by technology which is dumb in itself, so I think yes, this will affect teaching and learning, but I don't believe that this is going to replace. Professors or teachers in the short run, definitely not, not in the medium run either, because I think that the human contact between students and professors remains important in the long run. Maybe.

Interviewer [00:13:23] Also, because I noticed when we were in Italy, we could not access ChatGPT because Italy has banked because stating privacy concerns. So do you have any opinion about that? Like how do you feel about all the data that it's getting trained on in order to produce whatever the prompt students are asking?

Interviewee #1 [00:13:46] This is a complicated issue because if you think of copyright, for example, it is not yet clear and it's not even clear to copyright lawyers. And I'm not a copyright lawyer, but how to address the input and the output side so the input side of any algorithm is how you feed the algorithm and what kind of material you put there and the output then is what the algorithm is producing or the Chat bot is producing, so both of them might affect copyright because even the input side is something which has been done by a human before. So whatever takes your feed into such a system to make it learn it's done by humans, there is a human touch in that material on the input side. So somebody who is operating a chat system, AI based chat system might be subject to copyright issues and again the output of the same machine again might have copyrighted material in its belly, in a sense. And it's totally unclear how these copyright issues are solved. So there are issues and there are important issues, but we, as I said, we are very much at the beginning of the process only and we need to see where it goes and how we can deal with it.

Interviewer [00:15:16] Coming back to [University Name], do you think the university will adopt this technology in their teaching and learning process?

Interviewee #1 [00:15:27] There is no decision taken yet, but I do hope so. So we have at least at the level of my department, we have started to use it. We have a small task force where interested colleagues are now testing the professional versions of that and how we can make use of this. So we are at our lower level at the department we are already using and working with it. Whether the university is going to adopt it as a general tool in the future depends a bit on the business model of these systems, and what kind of professional solutions they offer. I think this will take much more time than our quick and fast fix for our department, but in the long run I think all universities are going to have a certain kind of solution to use these technologies for their internal bearings.

Interviewer [00:16:29] I think we are coming close to the end of questions that I wanted to ask you, is there anything else you would like to add or discuss before we wrap up?

Interviewee #1 [00:16:44] Well, I think that one of the critical issues is who controls AI and who controls these kinds of machines. And I think it is the most critical issue for the moment. So it's much easier in a way, this sounds a bit weird because I'm not a technologist myself, but it looks as if it would be much easier to program in an AI tool like Chittor or Bard or whatever then find a way to exert power with it or upon it, so it's very unclear who is going to be responsible for content which is there. It's very unclear who is liable if something happens, who is accountable for what these machines are doing, and just to download this to the end user is not the solution and we need to see a much more sophisticated policy. This course on it, how to regulate AI? The EU has started this process, there are directives on the use of AI. Both in force already and in the pipeline. So there I see a lot of work to be done and we assume as we always tend to make this an individual case. But again it's not, it's a social issue, it's an issue where we have to find a solution on the society level and not so much on the individual level. So both play together of course, but this is in the area you did not address in your. Your questions and I wanted to make that point.

Interviewer [00:18:33] I was studying about the AI act and also how the members of the Parliament are saying let's slow down the rapid growth of technology and AI and order regulations to catch up.

So do you still believe that that's the right approach in order to control these technologies?

Interviewee #1 [00:18:54] Whether it's important to slow down the process or not is I'm not convinced, but that we need to have a regulatory framework for it. I'm totally convinced and how regular frameworks are developed is the way that politicians and parliamentarians talk to one another, talk to experts and try to find solutions. Yes, this is the correct way to proceed.

Interviewer [00:19:19] Thank you. Thank you so much for taking out the time.

Interview #2 - Transcript

Interviewer [00:00:00] Let's start with your brief introduction. Your experience and the courses that you teach.

Interviewee #2 [00:00:23] My name's [Professor's Name], I'm associate professor of practice at [University Name] in the [Country Name]. At [University Name], I teach two courses in our core curriculum which are like Gen. Eds for liberal arts colleges. One is called industrial revolutions and the future of work and the other one is called the future of education, and they're both intensely interdisciplinary and designed to tackle large problems. And that's across our curriculum here, all students have to take eight of these and they choose from a basket of 200. So there's specially curated courses and a huge commitment by the university. My research is on skills and employability and the connect and disconnect between post secondary education and that space. Thinking about how we best create thinkers for the 4th Industrial Revolution. And also the climate crisis. For me, the disruption from both are similar. My PhD is actually in climate change negotiations, but I got tired of telling everyone the end of the world was coming. So I switched to robots. But you know the networks and structures that the solutions run through at the global level are the same. They're just different disruptions. So for me, it's not a huge jump, but perhaps for the Academy it is. So technically I'm in the political science faculty here at [University Name] and I'm the inaugural director of the [Center Name] Center for Teaching and Learning. So my job is to train the faculty to teach these skills across a very diverse student body that does not match the diversity of our faculty.

Interviewer [00:02:26] Have you used ChatGPT yourself and if yes, how have you used it?

Interviewee #2 [00:02:42] Yes, I have used ChatGPT. GPT 3 before the ChatGPT 3.5 and now GPT4. I use all three of them. I've been using them for everything. So in my teaching I've been using it to help with prompt generation for thinking about discussion forums. Sample questions for students to work on. My courses don't have exams, so it's not like that, but it's more for formative reflection on what you're learning and whether or not you're learning. So it's been really helpful for generating those. It's useful for producing rubrics, so I have some assignment descriptions. All of our courses in [University Name] have to have assignment descriptions on rubrics, but I was using ChatGPT to check if the rubrics were good, or aligned to the description, let's put it that way. Not necessarily good, but what would ChatGPT give me that had different parameters from what I had thought of based on the description the students were reading, and some interesting results. And then I'm training staff and faculty on it. So for the staff I'm using it to teach them how to write prompts for emails, for example, and I'm using ChatGPT to make the training decks. Because there isn't a lot out there on how to teach people how to become prompt engineers. What I think this is ultimately all about, on the practical, on the work side, on the skill side. On the Academy side, the training tends to be more about if ChatGPT automates writing, what are the writing courses for? So we have to break it down for the faculty and training there are about actually teaching writing is teaching thinking. How do you teach thinking if

it's not about writing? And so those are some of the stations we're having in the training space around ChatGPT and how we use it, how we train the students to use it. For me, it's a small piece of a much larger puzzle, which is the 4th Industrial Revolution. And in some senses it's a continuation of my research. It just happens that this technology in particular disrupts education. Whereas a lot of the other technologies disrupt work and have implications for what the nature of expertise is and what universities do.

Interviewer [00:05:36] The second question that I have is about how did you encourage your student? You answered it somewhat in previous question as well. But can you give specific examples of how you encouraged them to use it?

Interviewee #2 [00:06:12] I created language on my syllabus and then went over this on the first day and again later in the semester. Now keeping in mind the course is on the future of education, so it makes sense to discuss disruptive technologies and ChatGPT wouldn't be the only one we would be discussing, so the content fits naturally with the course in this regard. Also the majority of my students speak more than two to three languages, English being one of them. So thinking of ChatGPT as a translation tool is crucial at [University Name]. And at [University Name] the use of ChatGPT, when it's explicitly forbidden it is not plagiarism, it's fraud. So we have to go over the definition of fraud in the meaning of that. We often talk about plagiarism in the academy.

Interviewer [00:07:05] Sorry to interrupt. Did you say it's banned in [University Name]?

Interviewee #2 [00:07:10] No, no, no, it's not banned. I said if you are going to ban it for a specific assignment or something, and then a student uses it so they've got a misconduct, academic integrity breach. It's not a plagiarism breach, it's fraud. So explaining to them the difference in how we produce knowledge in the Academy Is one thing I've been doing in my class and encouraging other faculty members to do and talking with my library colleagues, the librarians at the university, of how we would change the dialogue around the value of citations in terms of fraud, not just plagiarism. That's one way I've been talking to my students about it. We've also encouraged all the faculty to have a statement on their syllabus about their rules for the use of ChatGPT. So we didn't say what those had to be, but we strongly encouraged them to have something on there. Whatever it is, it should be there and be clearly stated. So if you're gonna ban it, that's up to you as a faculty member, that's your academic discretion and academic freedom to do so. If you're not, in what context is it not OK? And we explained it's not OK to retroactively decide someone can't use it. So for my students, for example, I have a research proposal assignment. When we got to the point in the semester where I was introducing this assignment and getting them ready to start working on it, I pasted the entire assignment into ChatGPT and asked one of them to give me their topic. Like just the title and GPT produced the whole research proposal in 30 seconds. And I showed them that and they're sort of in shock. And I said you can do this and skip the whole experience, but why did you come here? So we had a conversation about that. This is me and my class with my students about, and my students are 16 students from 13 countries. The overlap is [Country Name]. I've two from the [Country Name], so maybe maybe 12 countries, but they all come from different educational norms around academic integrity. But they know it's not fair that some people have some leg up that others don't have. And we're quite academically rigorous institution. We're dry campus, you wouldn't come here if you wanted to, like, just go goof around in college. So they're opting into a pretty rigorous system. We have a 3% acceptance rate like, these are very high performing students and they don't like it when people in the classroom cheat. So that is a norm we have or at least a part of the context. But in my class, the only place I've banned it and I explained to them why was a live ideation in the classroom.

Interviewer [00:10:25] Does ChatGPT already affect the quality of learning and if yes how has it affected it?

Interviewee #2 [00:10:37] I don't know the long term impacts, but we definitely have students who are cutting corners with it already even on formative assessments where there's no grades. So for example, in my class, I have a weekly discussion forum and this is to help students with anxiety about speaking up in class and students with language. Varying English language capabilities who want to take some more time to formulate their ideas, and some students have started clearly using ChatGPT to develop their prompts. They're not as sophisticated in the answers, they are sometimes off topic and it's a waste of time to read them. So for those students I've spoken to them in office hours and said, the whole point of the discussion forum is to help you sharpen your critical thinking to help you differentiate the literature to help you be in conversation with your classmates. And those are all pieces of something that builds up to transferring skills from one context to the next, and you're destroying your opportunity to learn that by using ChatGPT. And I said you can use it, but don't use it lazy, use it to brainstorm. One particular student I just said what she was doing was lazy and she said, well, I just didn't do the reading that day. And I was like, then don't comment in the discussion forum. It's a waste of everyone's time to then have to be required to go reply to your silly comment. So I do anticipate some deskilling and I don't think that's unique to students. I think ideation will come in a different way like it's hard to sit down and write a cover letter now when all you really have to do is put in your CV and the job description.

Interviewer [00:12:30] So this is the learning part, but then there's the teaching part, on the professors and faculty side, how does the ChatGPT affect the quality of teaching?

Interviewee #2 [00:12:43] I don't think we know yet. I don't think it's that widespread. I think we won't know until universities start to go through cycles of accreditation. And we start to see evidence of it in different places. Our faculty using it to give student feedback. And is that good or bad, Who's gonna do the studies on those things? We do know things like ChatGPT can't be caught by GPT 0, or turnitin AI or those platforms. They have too many false positives, and mathematically just sort of a waste of time. So the effects on teaching are essentially the same as was of COVID-19. We have to do better at reaching our students. The challenge for a lot of large universities, of which [University Name] is not one, is that there are issues of scale. It is really difficult to improve your pedagogy when you're teaching a 404 with 50 to 60 students in each course. You have no time to do the things, the flying consultants who tell you to be student centered, like those people don't know that. So there's structural changes that have to come because of ChatGPT and they didn't come because of COVID-19, so why would they come because of ChatGPT?

Interviewer [00:14:19] So for current users, you think we don't know yet enough, but if I ask about the future, how do you see it in the future for learning and teaching? How do you think it will affect the quality of learning and teaching in future?

Interviewee #2 [00:14:34] I hope it must increase the quality of teaching. It has to. For the Academy to survive. And in this way, it makes teachers more efficient so that they can spend more time giving feedback, which is where most of the learning happens. This is the most crucial point. It changes what we evaluate in the academy. So this means we have to change how we teach and when you do a shake up like that, you usually get some new practices and fresh ideas. It changes long term memory for students, and it changes how we measure long term memory or the value we place on it. And so

grading becomes more expensive. Students need to learn how to critically evaluate generative output and right now, that's not a CLO on any syllabus. So that's a fundamental change.

Interviewer [00:16:05] What is your current perception of the role of ChatGPT in higher education and why?

Interviewee #2 [00:16:27] I guess the role is it's a disruptor. It will create massive efficiencies on the administrative side. So that's a disruption in and of itself. Now, whether or not universities then say, OK, you don't need admins because faculty you're now, you can automate that work and do it yourself. That's one way some universities will go, which will make work even harder for faculty. But as a disruptor, I think it has the opportunity to freshen the curriculum. This has to come from accreditors, they have to require it. Or there's little incentive for the administration to do that. But ultimately, if students aren't prepared for the job market, universities won't be worth a piece of paper they say they're verifying skills on that aren't there. That's why it's a disruptor also.

Interviewer [00:17:27] To give you examples for roles, we mean like a study buddy, collaborator, reviewer, you know something like that.

Interviewee #2 [00:17:42] I don't know that we know all the ways it's gonna have that kind of role because of the open AI app store, plugins. The plugin store replaces the app store and we don't know all the plugins that are gonna be created. We're kind of two months into the creation of apps, but for our new kind of app. So GPT plugins will have applications in education we haven't thought of. For example, a GPT plugin that monitors how tired you are so that you can more efficiently study. These are things students will start to use, especially those with money. But definitely a use is brainstorming and that kind of thing.

Interviewer [00:18:35] Some of the roles that you think it can have in future? You said, it's not clear yet, but what do you think would be its role again for teaching and learning? Some possible roles?

Interviewee #2 [00:18:51] It can generate test questions for you. It can create reading quizzes to teach critical reading. It can do everything with code, so I mean Microsoft's Codex or GitHub's copilot, all of those things change computer science and programming. And then in the art world a whole new discipline will emerge. So its application is actually not applied to existing spaces, but are creating new spaces in the academy. It will be able to check for consistency among sources which is a key skill for evaluation in the academy. So it's automating things that we normally take three years to develop in a learner.

Interviewer [00:19:50] I have a couple of questions again related to role, but this one is specific to the discipline of study. What role does chatGPT play in your discipline? Also considering the center of teaching and learning, can you speak on behalf of other disciplines as well? What kind of role do you think ChatGPT plays in other disciplines?

Interviewee #2 [00:20:23] In my discipline, political science or the social sciences? One of the things this is putting a lot of pressure on is take home exams and other alternatives to high stakes exams that we've spent years trying to put in place. And putting pressure to go back to a blue book with pencils, which does not support neurodiverse students, is anxiety provoking, not good for the learner and is not demonstrative of the kinds of skills you'll need in the workplace. It's an outmoded way of doing it, but you need to verify skills, so there's this short term challenge and assessment and social sciences. Where everything's coming back face to face. I don't think it's a long term challenge. I think we'll

come up with alternative assessments and new CLOs. In other disciplines, like right now in computer science, it's a really interesting and exciting phase. But there are students walking away from these majors across higher Ed. This was demonstrated in the human AI index report from Stanford last week or two weeks ago. Just explaining that the numbers are shifting and students are going away from programming whereas they had just ran to it. It's automating huge chunks of research and education in computer science, it's creating new spaces in LM's where we haven't been hiring, recruiting or training people. Programming is not necessary anymore. I heard one story where a post doc from Harvard was going over for a job interview at Oxford, maybe three weeks ago, so he'd made it all the way to the job talk phase and he flew to Oxford and when he got there, they told him the search was canceled and that they were reevaluating whether or not they needed this field at all and reevaluating their whole CS program because of ChatGPT. So the change is that fast for that discipline. But this changes whether or not you need skills like technical and vocational fields, taking minutes for a meeting, you don't need to do that skill anymore. Executive assistants, those kinds of training programs have to be rethought. Travel agents, real estate agents, these aren't degrees I have in my university. But those disciplines will probably go away.

Interviewer [00:23:19] You talked about some other disciplines, but at the center of learning and teaching, have you discussed ChatGPT and its role and usage because I assume there are people from multiple disciplines in that center?

Interviewee #2 [00:23:36] Yeah. So the center is addressing 26 majors across four divisions, social science, sciences, arts and humanities and engineering. So, for example, in the arts and humanities, that's where we offer our first year writing seminar for all first year students. And the way they've been teaching writing may need to fundamentally change. And they know that they know expository writing programs around the world are disrupted by this. They know maybe it's outdated to teach people to write the old way. But we're in a transition phase. And whether or not that transition takes three years, five years, six months, we don't know. So the conversations are around teaching information literacy way more than we were. Not just how to do a citation, but what is the authoritative voice? Because the challenge with ChatGPT is that there is no authoritative voice. You don't have the context of the author, the time, place, gender identity, intersectionality of the author, the safety within which or lack thereof that they're writing these kinds of things are missing. So it's changing how they teach information literacy in our writing programs, for example. I'm not entirely sure how it's changing engineering. I know GPT 4 has mostly overhauled calculus and I don't think we've had time to look at how it's managing latex based courses? But I think that's just a matter of time.

Interviewer [00:25:22] Can you refer to other people who are into this area and have you had discussion with them and if you can briefly touch on their opinions about it?

Interviewee #2 [00:25:39] Yeah, Asli Hassan, she's the head of the Center for teaching at Khalifa University. And very interestingly, they are one of the initial pilot schools for Microsoft's ChatGPT 3, Azure. And so I've been in regular contact with her about How that's going, should [University Name] consider it? And why use Google at campus? Google's version of copilot is replete, and it's really not developed yet. Copilot isn't on offer for universities as a subscription yet, so we are looking at either codecs DALL-E or Azure GPT 3 and what we're finding. So Asli would be great to talk to, she's at Khalifa. She's the director of their CTL and responsible for training on this. There's another much more famous person Maha Bali. She's at the American University of Cairo and she's sort of the leading expert on all things teaching in the Middle East, if not the world, I don't know how often she

cited in the West, but she's phenomenal and she has been doing tons on ChatGPT already, but she's sort of one of those people that has two professional presentations a day. But at the end of the day, she's a staff member in AUC's CTL Center for teaching and learning. But just even accessing her talks on YouTube would be interesting. I know she's been doing a lot of work on that from the Middle East. And the thing to remember about the [Country Name] that makes us different is the Minister of Education has said all schools in the K through 12 space will have a GPT AI tutor for each student starting next year. And like just last week, [University Name] did a big media splash, they put all their ChatGPT guidelines on their website. And it has put pressure on the rest of us to make ChatGPT guidelines publicly available. I don't know what those would be. But most universities aren't banning it. So it's very interesting here.

Interviewer [00:28:43] Some universities and countries are already banning it or putting restrictions on it. So one last question, if there's anything that you would like to add or you want to discuss?

Interviewee #2 [00:28:58] Yeah, I'll just say that one thing that's been interesting to me is conversations around whether or not to develop an honor code for universities and why that's so controversial, like it seems like an obvious, easy win and something you can do with students collaboratively. I haven't dived into the literature, but I'm hearing lots of universities as this might be one of their response items, but then it goes into committee and dies. So I don't know if you'll find that from others, but I thought that was an interesting outcome of that. I flew last week to New York for a brainstorming session on that. So I'll just say the other thing that we've been thinking about is well, two things. Who's gonna do the prompt engineering training of the students? Is this gonna be like for example the career development center? Or the librarians or the academic tech, or who? Cause typically Centers for teaching and learning are not students facing they are faculty facing. Even though we're trainers. And then grants for teachers to develop new syllabi based on this, is another action that some people are taking to incentivize faculty to move on this, because not everybody wants to. But I don't know if that's gonna work, but this concept of going from a tool set to a skill set to a mindset is what [University Name] is broadly working on. We have to move all the faculty through this technology to a mindset and that I think will take years. So we'll see what comes next. I don't know. Small grants for faculty may be one way that different universities are going to get them to change their syllabi, because I don't think this is gonna be one full swoop where the university shuts down for a week and trains and trains faculty, although that would be my dream.

Interviewer [00:32:20] Yeah, I read it in your article as well. So, alright, I think we are done. Thank you so very much for your time. Let me just stop the recording quickly.

Interview #3 - Transcript

Interviewer [00:00:19] Thank you very much for your patience. Let me just quickly dive into the questions. So let's start with your introduction. Your experience and the courses that you teach.

Interviewee #3 [00:00:37] Sure. I'm in my first year of being a professor at a university. I just finished my doctorate after about 15 years in K through 12 schools in education, mostly in middle leadership in those schools. Curriculum coordination, assessment was really my focus. And then leading, especially learning support teams special education, So those were my specialties and I was in a variety of places around the world. Now I'm here at [University Name], and I'm teaching in the school of education. My teaching, I have my research methods class, I have an effective assessment practices class. I am working on inclusive education courses, and I also do a school improvement class. They're all at the graduate level. One of them is entrepreneurship and design thinking class. Entrepreneurship

and design thinking and inclusive education class, they can be either undergrad or graduate, depending on. It's an election course for them. But then my research focuses on assessment, assessment and data use specifically. Assessment in schools, how we assess students and then how we use the data from that assessment to understand the student outcomes and student learning and to plan for future interventions. The underlying sort of theme under that is to include more students and provide better opportunities to learn through effective assessment through effective data use.

Interviewer [00:02:33] Have you used ChatGPT and if you have, how are you using it?

Interviewee #3 [00:02:40] Yeah, so we're using it in a few different ways. I don't know how I was selected for this panel, but I was, or enough for this research, but I was on a panel about ChatGPT and AI that was probably where my name got thrown in somewhere, but I was put in, not necessarily, for my expertise in ChatGPT but for my expertise in assessment. And so it's impact on higher education, what will that mean? For how we assess students and things like that? And so being part of the panel, necessitated that I'd be familiar with ChatGPT, and then I considered it in my practice and included it in my practice. So I did. Within my class there are a few ways that students use ChatGPT. One is there was one particular assignment where they were required to use it to develop a student profile, then which they would plan accommodations for an assessment. So a profile of a student, they would use ChatGPT to develop a profile of a student who had learning needs, and then they had to develop an assessment accommodation based off of what that profile is about. So it's something that I've used in that way as a tool for students to actually use as part of their assessment. I've also encouraged students to use it as a starting point for their work. So again, within that same, that was quite a long project that they had to do an assessment plan for a unit of learning. And within that I also said, you can use the ChatGPT as a starting point for creating your assessments. So you can enter in a prompt. we explored several different prompts that you could enter in order for them to create a basic starting place for it but the requirement was that I have no problem if you use ChatGPT or any other AI function, or even any other resources, because there are so many resources for assessments online already so I don't have any issues, if you're using these resources as long as you cite them, and then include a paragraph about how you modified them so you should always approach these AI, the work that you do with AI as a starting point, because it can spit out a lot of nonsense as well. So we worked through it with that sort of approach. And then in research, we're using this in research as well. I'm doing a large study on data use in the [Province Name] and so one of my RA's is particularly good at using AI tools so we're writing a methods paper on using AI to help qualitatively analyze our data or to analyze our qualitative data.

Interviewer [00:05:52] Have you encouraged your student to use ChatGPT? If yes, how? Can you give me more examples or use cases of how you have encouraged your students?

Interviewee #3 [00:06:09] ChatGPT became a conversation just this semester. So it was one of those things where you did it on the fly, and as it came up. I did require them to use it at one point, and then I talked them through the processes of using it at another point. We also did a demonstration on how to ask the right questions, and then follow up those questions to get more refined responses from ChatGPT. Some of them are using it in their RA work to like case studies and other aspects, as well. So it's limited at this point, because, as I said here, it's brand new. It's new to me, it's something that within the past few months has really become a tool that people are using. And so we've used it in limited ways but I feel it's a good start.

Interviewer [00:07:16] What is your current perception of the role of ChatGPT in higher education and what are the reasoning behind it?

Interviewee #3 [00:07:27] I think I touched on that before. ChatGPT, I think, as a general tool it's a tool. So it really inquires human interpretation and human work and human refinement afterwards. I believe that it's a good starting place, and it will likely develop as a better and better and better tool. As technology moves forward, we become more refined in our use of it. As more platforms are being used, this is something that's going to evolve. I had a moment when it was first presented to me of fear, what does this mean for me as a teacher? What does this mean for me as a human? How will this impact how I teach classes? Will I know students have cheated? Those questions have come up with myself, but eventually I teach courses on effective assessment practices. So I have to manage that sort of emotion around like, how am I going to assess students? So I can't run away from that, or just be like oh, I can't use it, or I have to stop my students from using it. Because it's clear this is the way things are going to be going. So I might as well engage with it as much as possible in the beginning, in ways that are appropriate. So I did have that moment of fear, and I still do have some aspects of fear from it. But you know, again, considering identity, and then what is my role as the teacher? But the more that I use it, the more that fear dissipates. The voice of ChatGPT is extremely recognizable. So when students, for example, copy and paste, it's very, very clear you can almost immediately catch on to that. It's this particular voice. So you start to talk to your students, you're like, look, I know this isn't your voice. What did you do? That's fine. You can use it, but you need to acknowledge it, and you need to make adjustments for the purposes of this assignment. So my adjustments for those fears that I have are one becoming familiar with it, two going ahead and encouraging students to use it and teach them to use it as a tool. So my thought behind it is, if I'm teaching them to use it as a tool, they're much less likely to use it as a copy paste exercise, and then three, have a policy with my students where, when they do just copy and paste when it is pretty obvious that I have a way for them to work through that, and just set up guidelines for them on how to actually work through it and use it productively.

Interviewer [00:10:32] Where do you see the future role of ChatGPT? And by role I mean like a study buddy, or translator, or someone who reviews your task. So if we are going in this direction, what do you think is the future role of ChatGPT?

Interviewee #3 [00:11:00] It's hard for me to predict that it's so new to me as a tool. I don't know, because I'm not deeply involved in the development of it. I'm not sure where it's going or its potential as well. I think it will probably end up being a tool similar to Google, not in that they do the same thing. It's not a search engine. I understand that difference very clearly, but a tool again, it's this tool that you can use in a variety of different ways for a variety of different purposes, and we will refine that. That is I think the human element of AI where that fear comes in, who are we If we have AI? What does that mean for us as humans? We are still the ones who influence the development of it, and how it's being used in the ways that it's being used. So I think that there's a lot to see in that I'm seeing use for it of course in content creation. I'm seeing use for it a lot in research and analyzing work as well. That can be really helpful, especially when you talk about qualitative data there's always this issue of trustworthiness with qualitative data. How do we know that our work is trustworthy? I think there's real potential for this as one of those sort of triangulation methods. But again I see the danger in that there's this assumption that technology is objective, and it's not. It's influenced by its creators and by who uses it, and the biases of its creators and by the people that use it come through in technology. So I think it has enormous potential in a lot of different ways but it will eventually

become like our Google search algorithm, where it's something that we use daily as part of our regular life. And it will expand in the ways that google has expanded as well.

Interviewer [00:13:13] Hmm, interesting. But if you limit it to like learning and teaching, what role do you see specific to learning and teaching?

Interviewee #3 [00:13:21] I haven't really considered that aspect of it. I think I've been thinking about how my practices will change and how my assessment will change. Can you give me an example of what you're thinking of when you say that? Or when you ask that question.

Interviewer [00:13:56] Yeah, like, I mentioned earlier, it could be like a learning body. You are learning with someone. You are asking questions, maybe getting assignments and in teaching it can be, like an assistant to a teacher who is using it for creating presentations.

Interviewee #3 [00:14:16] Yeah, I mean, it could be used in that way. I think that's one of its limited uses. I think it has a lot more potential than that. So, for example, my students had to use it to create assessments. So a starting point for their assessment. So I could definitely do the same thing as well. Should I want to do that so I could use it? Yes, as a teaching assistant. I myself probably would limit it, though the way that I'm not somebody who does a lot of formal pen and paper tests. Hmm! I'm struggling to respond to this.

Interviewer [00:15:06] Maybe I can ask another question which is regarding the discipline that you are in. Is there any specific comment regarding the role of ChatGPT, specific to your discipline? And if you can relate it with other disciplines as well, because I assume your experience is not specific to your own course. It's more towards learning and teaching in general. So if you can comment on other disciplines as well.

Interviewee #3 [00:15:36] I've seen from a lot of my colleagues as well again that initial feeling of fear with ChatGPT. How we know if students have cheated, and I think that will be all the way from elementary school on up through higher education. I think that fear will be prevalent, because and again, I'm looking at this through my particular lens of assessment in data use because the way that we assess students is not in general, I think the way that we assess students is not authentic. We don't engage in authentic assessments regularly as a practice. So it's not true to life. It's not true to context. It's not something that's actually usable. We use really general papers for them. Essays that are very, very general, that can be replicated by ChatGPT. So I think that one of the good things about this is that it will force a change in education. It will force teachers to have to consider authentic ways of assessment where it can only be used as a tool and not as a copy-paste exercise. You can't just tell a student to write me a paper about the sun, you will have to tell the student, it has to be something like, write me a paper about how the Sun impacts your life personally, or let's go ahead and do a research and action report where you do initial research that perhaps ChatGPT or other things start you on. But then you have to apply it to your own sort of experiment. So I'm thinking of teaching in elementary school, when I say that. So you know, thinking about elementary school kids doing a report about the sun, they're not gonna just go and have ChatGPT come up with something for them. They're going to start there and then apply it in some sort of project based learning.

Interviewer [00:17:45] Yeah but we are just focusing on higher education.

Interviewee #3 [00:18:00] It'll be the same thing. I think it will require us to develop assignments that are really, really specific and authentic, and there's not a lot of that work being done in higher education at all.

Interviewer [00:18:04] You said it will force teachers and it will affect education. So does it already affect the quality of learning, or what are your thoughts on that? And if yes, like, how do you think it is already affecting the quality of your learning?

Interviewee #3 [00:18:44] There are students who will copy and paste and answer, or plagiarize and answer, no matter what. Usually it's because there's some other issue going on. It's usually not because they're a bad person or because they are cheaters. It's for the vast majority of students that I've seen this with, it's with students who are struggling with language. Who are struggling to write, who are struggling to meet the expectations of the class, and they're so overwhelmed that they can't even begin to break down the assignment and do it correctly. So when I've seen students copy and paste anything from either, from research papers or from AI technologies. It's those students who are really overwhelmed. And so I think that it gets into the deeper issues again, of teaching and education, and what we expect from our students. It gets into this understanding of who our students are and why they're struggling rather than the ability to take that as a tool and use this as a tool. That difference is happening there. So I think that issue really comes through in learning those students anyway are struggling to learn as it is, and this is just how they're coping through it. This is my opinion, in my observation. So I don't see it as they would suddenly start learning if they didn't have ChatGPT. They're coping, no matter what. So unless I change my instructional techniques, or unless the program changes to meet the needs of that student, no matter what they do, they're going to be coping and learning will be limited, it won't be maximized as it is. So I don't see it as a hindrance or a barrier. Again, it's all about how humans choose to use it and that is a reflection on the teaching and learning itself.

Interviewer [00:20:57] You talked about learning, but in terms of teaching, if I ask the same question again but from a teacher's perspective, because they both are related to education. But from a different perspective from the perspective of a teacher. So what do you think about the influence of ChatGPT on the quality of teaching?

Interviewee #3 [00:21:41] I think that that goes to the earlier point that I made, that I believe that it will force teachers to reevaluate how they assess. And then, therefore, that will force teachers to reevaluate how they teach, because assessment and teaching essentially go hand in hand. Would you like me to move further with that? What was that?

Interviewer [00:22:12] Yeah if you can give some examples, maybe from your colleagues like how they have used, or they haven't reported anything, where they saw a change in the quality of education.

Interviewee #3 [00:22:23] My colleagues have just reported when students are obviously using it to copy and paste. I think we're at a point, and perhaps it's here, perhaps it's the place where I'm at, but it's not at a point where people have really grappled with it very much, I think, in my department I'm one of the few teachers that have really attempted to work with it.

Oh I do have one concern, you asked if I have any concerns, and this was something that I said in the panel. My major concern with this tool is widening inequities. So there's potential in ChatGPT for

breaching inequity and breaching gaps. But I don't really see technology as being used in that way. There's always potential for technology to be used in productive ways that reduce inequities. But I just don't see that as being the reality, the potential is there but the reality doesn't always exist. And so what I see is, for example, those students who are already great with English, who know how to ask the right questions, who are comfortable with technology. They can immediately engage with this tool, ask questions, get a base, and then develop it into really sophisticated work. Whereas those students who are struggling with English who are afraid of technology who don't have access to technology have to start from scratch or only use it as a copy and paste. So their use of the tool is limited or if they don't use it at all. So then, as a result, the student who's already pretty comfortable can go that much further, whereas the student who was not comfortable in the first place, stays essentially in the same place. So in higher education, I think that this is really one of those potential tools to help people go forward. But unless we really consider, this exists within the system of inequity, and therefore, I think the way that technology uses benefits those at the top already, and I think this is one of those tools that has the the power to benefit those at the top and do not very very little for those at the bottom.

Interviewer [00:25:15] This is really interesting and important and I think it's related to the previous question about the quality of learning and how it is affecting. So you see it as a tool that is creating further inequalities. Is this correct?

Interviewee #3 [00:25:27] That. Yes, that could create further inequalities. Yes.

Interviewer [00:25:33] And what do you think, how can we resolve this issue? or do you think it can be resolved or can't be?

Interviewee #3 [00:25:48] It's not a problem with the tool itself, because the tool has the potential to be used in very different ways? The tool ChatGPT is not the issue. The issue is access. The issue is the systemic inequities that prevent those who are, especially in [Country Name] in rural areas, women, young people, people from lower socioeconomic classes, people from different backgrounds, people from different languages to really engage with this tool in effective ways as a tool. So therefore the system itself perpetuates these inequities and this is a reflection of the system. AI is a reflection of who we are, it's a reflection of our beliefs. It's a reflection of our content and knowledge that we have as humans. And so therefore it's going to reflect in our inequities. So I don't think that the tool itself is the problem. I think the system is the problem.

Interviewer [00:27:01] Any specific steps or things that you can recommend that you think might help reduce this inequality if not remove it completely?

Interviewee #3 [00:27:07] I think we're talking about social reform.

Interviewer [00:27:20] But let's say, we focus on like a student within a classroom like there are some who are good at it, and there are some who are not, like you mentioned that students who usually copy paste and plagiarize it's not necessarily that they are bad student, or maybe they are struggling with the language, or are some other issue, so can you think of anything that can be done within the classroom? Not like changing the whole society, but within the classroom. If we can bridge this gap between the two apparent groups?

Interviewee #3 [00:27:48] There's been a lot of studies that have shown that orientations and not just orientations to universities like, here's the library, and here's this and here's that but orientations to technological tools really help develop self-efficacy, especially student self-efficacy, learning self-efficacy. So I think when you have quality orientations that orient students to the tools, not just here's your password, and here's how to access it but here's how to use it productively. So this is not a one day or one week orientation, it's a amore significant amount of time. But there have been studies and studies, especially if you look at online learning, non-traditional students were doing online learning, that orientations, especially to the technology really help develop that self-efficacy. So I think that that's one key thing that you could do is ensure that all of your students come in with some level of knowledge about how to use and skills about how to use these various technological tools, including AI, and I think that higher education does a very poor job of providing accommodations and access to students who have learning needs students from different learning backgrounds. Again higher education needs to do a much better job at providing accommodations and access for students with learning needs, especially with the first language backgrounds that needs to happen. It's a really interesting reflection that I'm a professor here in [Country Name] and I don't speak any Urdu and I can get here simply because I speak English, not simply, I have other qualifications. Students who come from a very different background might really struggle in my class, and that won't have anything to do with technology. But that will impact their use of the technology. So there's these different aspects that we have to pay attention to personally as professors. Who are we? How are we interacting with students? What are we expecting from our students that we need to think of as university-wide systems in how we support students either through inclusion and access or through orientation programs and continual development technology?

Interviewer [00:30:18] One last question, which kind of popped up from another interview that we conducted is, how can we do this incorporation of ChatGPT, specifically. Should it be done by the professors who are teaching the course? Or should it be done by some specific department within the University who take care of the quality of education. What are your thoughts on this? How it can be done again in the context of inequality, the issue of inequality that you mentioned?

Interviewee #3 [00:30:42] I think it has to be done both ways. So you know, universities are weird places. They're very niche. Everybody is in their own niche in their own world. Like one school operates completely different from another school, and the expectations of professors in one school are completely different from the expectations in another school. So whereas at one school you could do a very top-down approach of everybody's going to do this. This is how we're going to do. This is where we're going to address it, and another school where there's a lot more autonomy like in the school of Education. Here we have a huge amount of autonomy. So when there's a lot of autonomy, you have to get buy-in from the professors as well. So I think you have to do a top-down approach at a bottom-up approach. Really finding people who are willing to work with it, and to you know, if we talk about like diffusion of innovations, we go back to that old, old thought with Rogers, you know, to be the first adopters of new innovations, you really need to make sure that those things happen because academia, is so niche, but the things like student orientation that definitely can be done from top, from top down. That can just be a part of what's done for students as they come into school. Access and inclusion should be a part of what's done, no matter what.

Interviewer [00:32:17] Any last comments, thoughts, suggestions that you have on this.

Interviewee #3 [00:32:20] No, I think I've covered my major thing, which is always inequity. All of my research, everything that I do is filtered through addressing issues of inequity. So that's always my key point.

Interviewer [00:32:34] Okay, then, thank you very much. Let me just stop the recording.

Interview #4 - Transcript

Interviewer [00:00:01] Thank you for taking the time. Could you briefly introduce yourself and also which course do you teach?

Interviewee #4 [00:00:11] Hello, thank you for this opportunity. I'm doctor [Professor's Name], working as associate professor in [University Name] Institute of Science and Technology, [City, Country]. I'm also running a startup, I'm also founder and Director of [Startup Name]. So I primarily teach AI based subjects only. So currently in this semester, I am teaching AI, artificial intelligence and then data mining. My area of expertise, primarily lies in the natural language process. That's about me.

Interviewer [00:00:53] Thank you mam. So have you heard about ChatGPT before and have you used it before?

Interviewee #4 [00:01:01] Yeah, of course. The buzzword of this era is ChatGPT. I've heard of it. Being in the natural language processing research domain, and my company itself is into natural language processing related products like for translation, machine translation or speech recognition. So GPT is one of the main models that everybody will look into. ChatGPT PT. Uh. Uh, yeah, certainly we have used it and we are thinking of how to fine tune it. Of course I'm aware of what ChatGPT is.

Interviewer [00:01:39] But have you used it in your teaching? Like have you used it for like having certain schedules or evaluating certain answer sheets and stuff like that?

Interviewee #4 [00:01:51] Not really. I have tested ChatGPT. I have used it for other research purposes like how we can actually fine tune the large language models. So what are the applications that can be built on top of that? But for my professional use like for my Academy I have actually not used it because it looks very, I might be going slightly in a negative way, fine tuning the ChatGPT and building some interesting stuff on top of that, I'm fine with it, but using it for our own purpose like I think it brings down some creativity so I'm not using that for that purpose.

Interviewer [00:02:41] That's a very interesting point you bring out. As you said, this is a buzzword and students everywhere are using it. So have you encouraged students to try it out in your classes or are they using it for doing your assignments?

Interviewee #4 [00:02:58] Of course to teach AI, so normally when we teach AI, we used to bring up some real time application to just match the concept. But right now of course we take ChatGPT as an example and we teach the AI concept that can connect or relate with students better. Students are using it, so even in the lab experiment earlier, when we give an experiment, they copy the code from either Kaggle. That effort, at least they were putting. So yeah, at least taking the code from Kaggle or some Geeksforgeeks or GitHub, they were taking that effort. So right now they don't put that effort in, they just go to ChatGPT or try out the code or even assignments. So when the assignments are given,

when you're supposed to write an assignment, the ChatGPT is not going to personalize for you, right? And these days, students are like, I don't know, some may be lazy enough to not even personalize for them, just copy paste. And so that way I have not encouraged students to use it for their assignment purposes or coding purposes as at least for now. Maybe when they go to the industry after their graduation, that point of time that may save a lot of time because they may not repeat the code so it saves a lot of time when they are building a product or they are building an MVP or whatever it is. So that might save time but not now. So it's like when we were studying in kindergarten or first standard secondary, they're not allowed to use calculators, right? So why were we not? Calculators can actually do faster when we actually move up in the level of education we were allowed to use a calculator. But not when we were so young. So that will actually block your mental capacity of creativity. That's what I feel. But students should not be allowed to use too much of ChatGPT. It will not increase their creativity or allow them to actually bring out their capacity. That's what I feel.

Interviewer [00:05:29] As you already know that it tends to hallucinate, right? It tends to put out the wrong information and also during my research I tried doing literature review on it and I saw that it was citing papers which do not exist. So do you think universities should also educate their students on how to be more aware and rather than copy pasting be more aware of what content it's showing them?

Interviewee #4 [00:05:59] Yeah, yeah, of course. So we have the responsibility to tell them like when the teacher is receiving an assignment or they are posting the assignment itself, they should be telling the students not to use ChatGPT. So even if they're using ChatGPT, it's OK, but they should be given an awareness of how to make it personalized or correct or validate whatever that ChatGPT is giving. So we're not supposed to blindly take it and bring it forward. So yeah, of course, that's our responsibility.

Interviewer [00:06:37] So as you also mentioned the role of calculators and how it helped education, do you see ChatGPT and other LLMs like Google Bard and etc. playing this huge role in education going forward?

Interviewee #4 [00:06:54] Not really. I have not explored Bard so far but we have used other Google related language models like Bert, Roberta. So those language models are not really bard, what are you talking about. Of course they will enhance the education, that's no doubt. But when they are actually coming into the picture, students' creativity or potential is actually brought down, that's where they will not actually be good. So we should know the boundaries like how to use these tools. If it is going to save our time that's fine. But that should not prevent us from showing our potential or I mean growing up our potential. The growing kids should be tap their creativity rather than tap some other tool, AI tool, that's very dangerous actually.

Interviewer [00:07:55] But nowadays, like students or as you all already said, students are using it. So how as the professor would you encourage them or stop them? Because when they go into industry, there is also a gap like I recently saw in the Andrew Ng Prompt Engineering course which is now there. So now this is like a new space where you have to be really fully equipped to go to the industry. So as a professor, what can you do?

Interviewee #4 [00:08:23] Yeah that's what I said. We should know the boundary. So we can use the ChatGPT, take it as a base model. GPT is a very good base model. So compared to other generative AI based models, GPT is a very good model, no doubt about that. So we can encourage the students to build some interesting applications, do some projects on top of that. But so we can take Andrew Ng's

course as you said. We should be aware of the state-of-the-art, there should not be a gap between academia and industry. Students should also know all these technologies when they graduate. So there should not be a gap. That's OK. But they should not be using too much so that their own potential is suppressed.

Interviewer [00:09:14] Makes sense. So just to follow up on this, because you already teach AI, so how do you think these tools will play a role in your discipline? Will the teaching of artificial intelligence and data mining in the future be affected? Will the students not rely on the teacher and just go to such tools for answering and having that deep relationship?

Interviewee #4 [00:09:40] Yeah. So even before ChatGPT came, the teacher-student classroom setup actually has already been affected by the voluminous teaching materials that are already available on YouTube. So even when you were here, like you had so many YouTube channels having lectures better than what a teacher teaches. So you can listen to all the Stanford lectures online. So that is all always there but still that's what we make it a point that whenever teacher goes to the students they should be having something extra to say. So the ChatGPT or the Stanford Lectures or whatever YouTube materials, what they cannot bring in inside a classroom? Teacher is supposed to bring that content into the classroom, so be more interactive like involve students and personalize your capabilities. Not all students are at the equal level, so these things ChatGPT or any online lectures. What online lectures will not bring, so maybe the entire curriculum setup, academia setup has to actually align towards this. Personalizing or I think we teachers should take that responsibility more now. How we should align ourselves to all these technologies and make ourselves better. So that's what I think about.

Interviewer [00:11:24] Makes sense. As you said, everyone is at a different level. So do you think here such technologies can play a role where I, as a student who is in level 1? Don't know. Can just go there and ask certain doubts and it would be more accessible than just talking to the professor and waiting for them to have time for me?

Interviewee #4 [00:12:04] Yeah, of course that'll help. So today, the classroom is not constrained to four walls. So the entire world is your classroom now, I think you don't need to depend 100% on a professor whatever level you are in. So for all levels you have online materials now. So technologies are there now. That is absolutely fine with the student. Not everyone will also feel comfortable coming to a professor, there's always a discrepancy, right? So of course, 99% of the students may feel comfortable, so certain people will not be feeling comfortable or the professors are busy, we are not able to handle. Yeah, of course we should encourage students to learn all these technologies beyond our classes as well.

Interviewer [00:12:59] Makes sense. You also talked about how you have not used this for your professional thing, saying it hinders creativity, but don't you think it can help you give some ideas and then you can build on top of it?

Interviewee #4 [00:13:14] Yeah, right. So there are two things. If you don't know, let's say you are building a skill. There are so many skills. So if you're going to talk about a particular topic tomorrow, a student is going to talk about the particular topic. So if they are not completely aware 100%, then they can use these materials to know about it. But if he or she already knows about 60% or 70%, they can actually upskill themselves not to just copy that. Just as a supportive tool, they can take it. Instead of just taking copy pasting as such and taking it and enhancing putting your own skill into that and enhancing that. That is a win, win situation, not to the technology and for the student as well.

Interviewer [00:14:10] So just a few more questions. As a professor, how do you see the future of classroom learning? How do you see it will get more involved and more changed or do you think it would be less interactive now with all these technologies coming up and students relying on them?

Interviewee #4 [00:14:31] Of course the dimensions are changing, it will change like post COVID it has already changed, the covid is actually put upside down everything. So we didn't even dream about having an online class, but that did happen. And now even we are bringing that into our curriculum in the 2021 regulation that we are actually framing now. So we have certain subjects where students can actually take it online. So they can opt online, they do not need to come to the classroom. So the dimensions will actually change then and yeah, so these changes will definitely come in. So maybe we may not have a classroom concept at all in two or three decades. So I don't know how exactly the change is going to happen. But definitely there's going to be a change and we have to adapt to that change. And seeing all these changes even our Dean has actually given us the project on building a humanoid professor. We are given funds to build this replacing us. So things might come, we don't know. We should wait and watch what's in for us.

Interviewer [00:15:53] But I completely kind of disagree with the replacing concept because that will never work and we always need the human touch is what Covid has taught us.

Interviewee #4 [00:16:04] Yeah, human touch should always be there, like a teacher is always different, a human teacher I'm talking about. Maybe when there is a lack of resources, scarcity comes. When the student teacher ratio drops or for certain subjects, you don't need a personal touch where it's completely something students can actually have online. So maybe case to case it will vary. So maybe we can have it that way.

Interviewer [00:16:40] That makes sense. So I'm almost done with all my questions. Do you feel I missed anything, or do you have any feedback or opinion on this ChatGPT in education both as a professor and as someone who has own startup working on these technologies. Do you have anything for the students or in the classroom structure?

Interviewee #4 [00:17:05] Yes, anything, not only ChatGPT, anything in this world whenever something comes, like mobile was not there when we were a kid. So I understand the pain that you are actually going through, right. So this is a huge deviation, whenever a technology comes, there's always a positive and a negative. But mobile has actually made our life easier in so many cases. So in a similar way ChatGPT has actually made so many things easier for us. It's up to how to take it positively, align it for us. We should not align towards that like we should align the ChatGPT for us. So that we don't get dumb, technology should not make us dumb. We should make technology helpful for us to grow. So the skill one has to have, students have to have. As a startup we are actually experimenting, how can we tap GPT technologies to build the generative based product. So that's about it. I hope I answered your question.

Interviewer [00:18:16] Yes, yes you did. But I just had one question. So because a lot of people are also talking about how these models are not accurate and it produces false information. So when building another model on top of it or having certain features which relate with the API of ChatGPT, do you think that bias will also automatically come into the products?

Interviewee #4 [00:18:44] Yeah, these are base models, right? So GPT models are based models. To build anything on top of that, we should customize it for that. For instance, if you want to actually make it answer for some manufacturing specific questions or healthcare specific questions. You have

to fine tune it with the customized data set for us like the healthcare system that we have in [Country Name] might not work for Denmark, right? So we have to take the base model and we have to fine tune it so that way I think it is possible to increase the performance I believe.

Interviewer [00:19:23] Thank you so much. I'll just stop the recording.

Interview #5 - Transcript

Interviewer [00:00:14] I have started the recording. So let's start with your introduction. Could you briefly introduce yourself and your experience? And what courses do you teach?

Interviewee #5 [00:00:30] Dr. [Professor's Name], teaching at [University Name] for the last 8, 9 years. Typically I teach courses related to entrepreneurship and social entrepreneurship. And there's a course called Social Advocacy and Community Service that I teach quite frequently. I have been teaching since the last 13, 14 years. So that's my brief introduction.

Interviewer [00:00:54] Have you used ChatGPT before? And if yes, how?

Interviewee #5 [00:01:02] Using it almost on a daily basis, instead of Google I'm rather using ChatGPT these days. Because oftentimes I have complex questions where I'm asking for data comparison for example, asking for specific details for which I rather have, if I search the same query on Google then subsequently, I'll have to read a lot of literature or articles which Google couldn't understand what I'm trying to ask it, and it kind of bring irrelevant stuff which is not really addressing my query, but chatGPT is able to understand what I'm trying to ask, and it is often able to respond to complex questions. As well, because it is quite convenient on the. So I'm using it quite frequently these days.

Interviewer [00:02:04] And have you encouraged your students as well to use ChatGPT, and if you ask, how?

Interviewee #5 [00:02:13] Couple of times. There's a presentation in one of my courses about SDG. Goals and I asked students to get answers to specific questions about SDGs. For example, there's lots of debate and criticism of SDGs as well, so it would be easier for them to dig out, using ChatGPT and then cross verify from other sources of what ChatGPT is saying the right stuff or not? So yeah, in a couple, of course, I actually asked. In fact, I also sometimes say this is what I found on ChatGPT, for example, what is the total market value of the industry which uses addiction as a means to make their customers stick to their products and services? So ChatGPT gave me a response, and I shared that with my students in one of the courses. So I think there's a couple of examples where I have engaged my students.

Interviewer [00:03:29] Okay, so some of the questions that we have are related to the perception that you have on the role of ChatGPT. So what is your current perception of the role of ChatGPT in higher education? And what are the reasons behind it?

Interviewee #5 [00:03:44] We have students who really want to just copy paste their assignments on the Internet. If you ask them to share their thoughts, or reflection, or a summary of some video, for example, which, already available on the Internet, that kind of stuff, you are asked to write an essay. So there was already a culture of copy-paste and now, thanks to ChatGPT students have found a much

more convenient way to just mention the query and they can just get the whole assignment done very quickly. So students obviously are not going to use most of their brains if the teacher is not conscious enough, when the teacher is not able to verify or understand the responses that are going to come. The written assignments, basically coming from students, are actually created by ChatGPT or some similar, so that's one of the main concerns. So recently, I asked students to watch a documentary and submit the summary, and I asked specifically that they should take notes, handwritten notes on the notebooks and once they're done taking notes while watching the documentary they should take a picture of the notes they have taken and submit those notes so that I can say that they have actually watched the documentary or not, or they've been able to understand what documentary is talking about. And also warned them that if I sense any kind of cheating then eventually I'm going to ask them to personally explain it to me in a face to face meeting, what they actually understood from the documentary. So these are the concerns. And this is one of the ways I'm trying to address those concerns.

Interviewer [00:05:54] This is the current perception that you have of the role, and you gave some examples as well. But if I ask you about the future role of ChatGPT in higher education and if we make it into 2 categories, one is for teaching, and the other one is for learning. So like from a students' perspective and from educators', perspective. How do you see yourself in future in higher education?

Interviewee #5 [00:06:28] It actually boils down to this dichotomous relationship that already exist between the teachers and the students in this typical university's educational structure that we have. There's some kind of an antagonism going on all the time, and students are trying to get away from the process of learning, and teachers are somehow trying to drag them back into the process of learning. But in essence, learning is not really taking place. And students already have this temperament because of this antagonism. The idea that they're really there to learn something is already obsolete. And ChatGPT is only going to further reinforce this particular tendency. But I don't blame ChatGPT because if you want to use it to learn something, save time reading a lot of stuff and creating a summary, ChatGPT can give you that very quickly. So I have queries and I'm trying to address those, so I asked ChatGPT to give me a summary of various things, and that saved a lot of time on my end. So I'm learning a lot from that. But again, if there is intent from students to learn rather than forcing students to learn stuff which they are not really interested in. It was kind of dragging students into directions without really looking at their intrinsic motivation, to understand that. So because of that, there was a lot of antagonism already so ChatGPT is kind of the final nail in the coffin or students would be able to copy past their assignments much more quickly like that. But somebody who is really interested to learn can also take a lot of benefit out of it as well. So this is something which I think is probably going to happen and it's not going to happen because of ChatGPT, rather it is going to happen because of the existing culture and this antagonism that already exists in the educational system.

Interviewer [00:09:18] If we talk about roles for instance, a person like a study body, or maybe an assistant for a professor. If you think of it like that as a person, then what roles do you think it can play?

Interviewee #5 [00:09:31] For example, if I'm writing a research paper, for example, I write a paragraph then I copy-paste the paragraph in ChatGPT and ask ChatGPT to tell me if it is okay? If there are any conceptual errors in that, and I'm talking about facts, or if I'm not being biased, or if I'm not generalizing something, then ChatGPT is able to give me a very unbiased not always unbiased,

but there's some time it is quite an accurate identification of some problem that exists in what I'm writing. So recently I wrote a paper where I checked every paragraph for every section by you know, taking feedback from ChatGPT and it gave me pointers where I can actually make corrections, and it also often rephrase the paragraphs for me if I was trying to generalize something over generalize something that it kind of change the tune of the argument to make make it sound more unbiased. So it is helping me in that context. And if it can detect plagiarism, for example. I don't know that I can use it for. I haven't done that yet, but maybe you can just copy-paste and ask ChatGPT if it is generated by AI or by the students themselves. So maybe that can help me out in that sense..

Interviewer [00:11:21] So you mentioned that you are using it for writing a paper. If I ask about the role in context of the teaching method that you have, like project-based learning or classroom learning, what is its role in relation to method of teaching?

Interviewee #5 [00:11:42] Oftentimes I'm asking students to think about certain things and search certain things on Google using their cell phones they have with them inside the classrooms. Or if they're carrying any laptops, then they can actually search stuff and have a more informed discussion about a particular topic. So in that context, it might work, but oftentimes the response which I get from ChatGPT is biased in certain ways. So one has to be careful while asking stuff. So I think there can be some possible use. Then the role of the teacher is to ask relevant questions, and the students can actually dig out stuff from ChatGPT and maybe the teacher can make multiple groups inside the classroom and give them different questions and they can look it up, and subsequently they have a discussion built on the kind of responses received from ChatGPT. So, yeah, I do see a possible application of that inside the classroom.

Interviewer [00:13:32] And does it affect the quality of learning and teaching? Again if you look from the students perspective and from features perspective, does it affect the quality? If it does, how?

Interviewee #5 [00:13:46] I think it has more to do with the underlying structure that we are using, which I just mentioned in the response of the previous question, it has more to do with it and less to do with the technological tools that the students are using in the classroom. So students are interested to learn, and the teacher is also very much there, if they are able to spark some interest in the students to think about certain issues and topics and really learn from that discussion, particularly, I think it is possible to do that. So it is not because of ChatGPT because probably the underlying issues already existed. There's some tendency to evade the whole process of teaching inside educational institutions.

Interviewer [00:14:36] So as of now, do you think it's already affecting the quality of learning and teaching?

Interviewee #5 [00:14:41] As of now. I don't think students are using it to that extent, a lot of the students were not even when I recently checked with them. The word of mouth is spreading quite quickly.

Interviewer [00:15:06] By affecting the quality does not necessarily mean improving it but also, maybe it's affecting in a negative way?

Interviewee #5 [00:15:14] Can you give me an example of how it can be affecting in a negative way?

Interviewer [00:15:21] I'm asking you. Do you think it's affecting the quality of learning and teaching in a negative way?

Interviewee #5 [00:15:25] I haven't experienced any up till now. There might be some experiences in the future I cannot predict at the moment, but I don't know. Let's see what happens.

Interviewer [00:15:39] Okay. One question is specific to your discipline of study. Do you see any specific role that it plays specific to your discipline? And maybe you can comment on other disciplines, if you have interacted with your colleagues who have shared their experiences, using it in their discipline as compared to your own discipline of study?

Interviewee #5 [00:16:21] Not much, I think. Sometimes I ask stuff about the specific political ideologies of the left side, the left wing, and it seems to have a bias in favor of that side, and I think there was already some controversy going on. Elon Musk recently also announced that we are going to create a TruthGPT, where the whole platform is not that biased in favor of the leftist. Oftentimes if I am searching stuff related to, for example, feminism, LGBTQ then there seems to be an inherent bias in favor of what the left actually believes and the views of the right are not that clearly? This could be my experience, I don't know. Maybe I framed the question in a way where that response was generated. But there seems to be some discussion going on also among the public, that it is kind of leaning toward being politically correct in certain ways. So when you talk about these issues, I've sensed a couple of times that there is some bias also.

Interviewer [00:17:34] So one question is related to incorporating it into the studies. Some universities are banning it, some are trying to incorporate it. How do you think it can be incorporated in conventional higher education right now? And who would do it? The professors themselves who are teaching a course? or there should be a different body or department within higher education. What do you think about that?

Interviewee #5 [00:18:24] I think it is ultimately the relationship between the student and the teacher that has to be in a way that the teaching actually happens. Knowledge actually flows from one direction to the other. But I think of course, the higher bodies within academia have to also allow for example they can block the access of the platform, and if they do that then none of the students will be able to access it. But up until now I don't think there is any clear discussion or understanding happening among the top management over here where I teach, so they're not very much conscious of the presence. I can only extrapolate or anticipate that if teachers are using this socrates' method to teach where they're asking questions and students are getting answers from the Internet and ChatGPT to get some facts, as far as my university is concerned, the top management seems to be very flexible.

Interviewer [00:23:48] It was disconnected for quite a while, but I think I have asked you the most questions, and concluded, so do you have anything else to add to the conversation or any possible areas that you think we should consider in our research?

Interviewee #5 [00:24:17] Hello, can you hear me?

Interviewer [00:24:52] I think I lost your voice, can you disconnect and rejoin? I think I have to conclude it here, because there's some problem with the connection.

Interviewee #5 - Post Interview Voice Note

So one thing which I'm noticing while I use ChatGPT specifically when I'm trying to write something, that there is a very strong temptation to just outsource the whole writing process to ChatGPT, because sometimes I have to think very hard to gather my own thoughts and to structure the sentences. Maybe because I'm not a native English speaker. So I find sometimes hard to just structure the whole sentence and I really have to think hard how to express it in the most academically in an academic style. Eventually, when I'm using this, though, there's a very strong temptation to just outsource the whole writing process to ChatGPT. And this, I believe, sometime has compromised my writing efficiency as well.

Interview #6 - Transcript

Interviewer [00:00:00] OK, so it is recording now. So let's start with your introduction. What's your background and what's your experience and specific courses that you teach?

Interviewee #6 [00:00:20] So I read your questions and I think in my background you'll understand some opening context. I haven't taught for quite some time, but maybe there's some benefit to the interview anyway. So my background is, from a teaching perspective, I started teaching university psychology back in 2008 and I taught undergraduate courses in cognitive psychology, general psychology, sensation and perception, neurobiology, attention and memory, developmental psychology, cognitive development research methods. Pretty much a very broad range of topics. And I did that for a while in [City Name] in [Country Name], which has a special higher education system. It is a little bit like what Denmark has in terms of professional schools in higher education space. But there in addition to those like they have in [City], they attach on the regular stream from high school to university, and go through these colleges. So high school usually ends a year early and university begins a year later. So they take those two years, the one from the last year of high school and the first year of university and they packaged them into a college. I taught at that level. So it gets at the very bottom of the university level and the very top of the high school level. And there I taught a similarly diverse range of courses, actually I got very diverse in terms of interaction and community, all in the psychology department. So interaction and communication, human sexual behaviors, general psychology, research methods, things like that, cognitive psychology as well. In addition, I was teaching at the graduate level, rather, at the university in the Education Department. So outside of psychology, I was in the Education Department teaching cognitive development courses, research methods courses, statistics courses. Social and emotional development courses. So quite a broad range of psychology courses. I did that for a while, and then I switched in around 2014 to pedagogical development for academic development. So I still taught at the time, but I became somebody who supported university professors in their teaching. So helping them develop their teaching methods. I did that for a while, maybe a year or two before becoming an assistant Dean of academic development. So then I started in a managerial role and that's when I stopped teaching. I did that for a year and then I became the director of a Center for teaching and Learning, where I ran the university's Center for teaching and learning. I did that for five years and then I became the Vice President academic or the Chief academic officer at one of these colleges that I was just describing and then I did that for a year.

Interviewer [00:04:04] So you are originally from [Country Name] but now you are in [City Name, different country]?

Interviewee #6 [00:04:17] So all the career progression I described right now was in [Country Name]. And then as of January, I've moved here to [City Name, different country] and right now I'm working on sort of like contracts. They are still education related global development projects.

Interviewer [00:04:34] So if we quickly go to the second section which is about usage, roles and quality. Have you used chat GPU? And if yes, how?

Interviewee #6 [00:05:17] I have been using it mostly out of curiosity just to see how the ways you formulate questions to it or prompts affect its outputs and just generally evaluate the kinds of outputs that it produces.

Interviewer [00:05:34] So what is your current perception of the role of ChatGPT in higher education and why? Considering your background in pedagogy and teaching and learning.

Interviewee #6 [00:06:03] Yeah, given that I personally very much enjoy things that emerge and disrupt education. I think it's fantastic. I'm not saying AI and ChatGPT in general are fantastic, but I love the disruptive qualities of something like ChatGPT because it's very rare that teachers sit back and think about their pedagogy, like university teachers, professors sit back and really reflect hard on their pedagogies. The pandemic did that and I see ChatGPT doing that. So I sort of a pedagogical professional, I find that very rare and welcome opportunity to have these kinds of discussions. And that's just sort of a very high level comment. More specifically about ChatGPT, what I think is actually quite interesting about it is that often what we strive for in a classroom with our students is to get them to produce content and frankly I have to say one of my prior roles, I was responsible for academic integrity at a 10 thousand student college and the constant treadmill of plagiarism and whatever I had to deal with in that role. It almost becomes a bit nihilistic in the sense that you think, well, we never really know who's producing these texts that students bring into the classroom. We hope, we often just sort of turn a blind eye and say we hope that the things that they bring in are things that they've written themselves. I know for a fact and for my role that often that's not the case, and I know for a fact that even more often, is probably not the case, but we just don't know it right? So I like it from that academic integrity slash pedagogy perspective, I think it's very interesting that we now know that you can get very intelligent responses just on the internet that would probably pass a teacher's evaluation if they're only looking for can this student bring back to this classroom an intelligent summary of a topic or an intelligent analysis of a topic or intelligent content. So that I like, and I like it because I'm hoping. There are lots of people, I'm listening to lots of the conversations around there about how ChatGPT will be affecting education and I think some of the better ones do say we do need to turn the page on plagiarism. ChatGPT will be producing content and we won't be able to detect it or we have to try to detect it but I've never been a fan of that. I've always been a fan of how you work with these things to raise the level of what we're asked teaching and asking students to do? with content? I think now we can say, it's probably not a great idea to be asking students to reproduce things that computers can do. I think there might be a benefit for it, but that's not what we

should be evaluating them on, I don't think. So for instance, there's a classic educational outcomes schema that was introduced by Benjamin Bloom back in the 50s, called bloom's taxonomy of educational outcomes, and it's used very popularly. Lots of teachers once they start trying to get into pedagogy, they land on bloom's taxonomy. In bloom's taxonomy. I think it's kind of a very interesting communication tool in the sense that it says the very lowest levels of learning are basically memorization. Once you get beyond memorization, once you're able to memorize something, then you can maybe then understand it. That would be a higher level of learning and once you can understand something, it's probably the next level of sophistication and learning would be to analyze something. And then once you can analyze something you know, then you're able to apply it to various circumstances and the idea with Bloom's taxonomy, it moves up this hierarchy of learning. And at the very top of it are basically the ability to create, in this case content, and another one is to evaluate content, and I like what chat GPT does because it really forces it makes creation so easy that there's probably a lot of work to be done on helping students be able to evaluate content. So ChatGPT can just whip out a like, give me an explanation of Hamlet, you know. And you see an explanation and you see maybe two or three of these things, do they have the skills to be able to say this explanation is better than this one because of that? And that's a sophisticated learning process. But in the end, and it's going to be built and to get to that level, you're gonna have to be able to know things. You're gonna have to understand the content. You probably would need to be able to produce an essay, but given that we can make essays now just by clicking buttons. A real student, a real human now needs to sit on top of AI and not be underneath it. So they need to sit on top of that and say this is really good, this is not really good because of that. And right now ChatGPT and AI systems can't really do that. But it's not something new, conceptually, it is a very familiar thing with AI is that now that AI can play a lot of these different roles that we needed humans to play before, we now need to learn how to rise above it and to put in more human needed thinking and intelligence to help compliment what the computers can do, and I think ChatGPT is a good example of that.

Interviewer [00:12:50] So if we take this thing and talk specifically about different methods of teaching, how do you see this in different methods of teaching because you have a background in pedagogy. Project based learning, classroom learning, remote learning. How do you see its role across all different modes of learning, methods of learning?

Interviewee #6 [00:13:13] So if I were to be using this in the classroom right now, and again like I haven't done it yet and I haven't really brought myself up to speed on the current practices, but I do know I have been looking out there and I do know that many of very good teachers are experimenting with how to integrate it into their classes. One of the first things I think is to integrate it into the learning. To pretend like it's not out there and it's the enemy, I think it is really gonna limit the kinds of learning that can be done with it. So once integrated, if I were to be using this, I would be using it along the lines of what I've described is, in a way that is independent of ChatGPT, I would be teaching, working with students to learn the fundamentals of a particular topic, to learn the conceptual landscape of a particular topic, to learn how to analyze it. But then at the end I would love ChatGPT because it can really produce massive amounts of content that can be used very dynamically in a setting where then you can teach, I would be then very happy to be able to teach students how to

evaluate arguments and how to evaluate certain structures of the content that the quality of arguments, the quality of a summary. Those things would be pretty amazing because because they rely on a lot of data, they rely on a lot of content to be able to review, to review five different summaries of a topic and and discuss what makes this one better than this one or the pros and cons of the various let's just say summaries. To me that would be amazing because you would be having very rich intellectual discussions around very deep aspects of argumentation of content and quality that are very difficult to get at when you're relying just on student produced content.

Interviewer [00:15:15] Can you comment on what role it would play considering different disciplines? Because I mean, your primary background is in, I think psychology and then pedagogy, which is again somewhat related, maybe educational psychology. How do you see it across different disciplines or do you have any examples or did you talk to someone from different disciplines?

Interviewee #6 [00:15:43] That's an excellent question. So in my view of ChatGPT at this moment I see it as a writing substitute, if you will. Now I know that it can be used, in terms of students and teaching and stuff, that's how I see it the most. I know it's used in various ways like with my daughters, for instance, I'll ask them to use ChatGPT to get them study notes on various topics and that seems to work fairly well. But again, like once they do it, we'll sit down and we'll go through it and we'll say like, I'm not so sure that's a good way of describing this. Why don't we go back and try to fix this or look this up or confirm that. So that's one way of using it, but the other thing that I would point out is that writing means something different in all these disciplines. So when you talk about writing in chemistry, for instance, or in engineering, it has a different meaning and also different norms and different different rules and all that in chemistry then it does in philosophy or if it does in the Fine Art. So if it's being used as a writing tool, it's going to need to be integrated and approached from vastly different perspectives depending on your discipline. I'm a social scientist, I consider myself a social scientist because of the education and psychology kind of fits in there. So for me that's an interesting way of combining narratives and data, which I think social science is kind of the balance between. The philosophy, if you go into the humanities, it's mostly narratives. You need narratives, and they need to be unique and they can't be already said. In the sciences, you can't make a point that hasn't been made, five times published and you can refer. So it's different ways of approaching these things, requires different, I should say the different forms of writing in all of these different disciplines is gonna require different approaches. So I haven't seen a vast set of examples across disciplines at this point. I have seen some examples in the social sciences. I've not seen anything in the STEM fields. In the STEM fields, what I'm seeing right now is, and and again I don't have an exhaustive knowledge of it, but what I've noticed the most in the stem field, they don't care because they don't write, like in a math class you don't write. So I don't hear a math teacher really talking about it much. Or they talk about it in terms of plagiarism and the issues that it poses for plagiarism. The plagiarism thing I've seen in all the disciplines, but I've seen the most interesting ways of trying to integrate and adapt to ChatGPT in the social sciences and humanities and that's where they're actually asking students to use ChatGPT to do certain things and to acknowledge that they're using it and incorporate it into assignments. And I think that's pretty much the only way to approach this, to take a very discipline specific integration approach.

Interviewer [00:19:30] Right, you are talking about integration. How do you think it would affect or do you think ChatGPT is already affecting the quality of teaching and learning? When I say teaching, it is from teachers' perspective and when I say learning, it is from students' perspective.

Interviewee #6 [00:19:51] Yeah, I think that's probably what's happening, I think it is in a very chaotic fashion right now. It'll take education quite some time to adjust to it. But right now what I see is a lot of panic, mainly from the academic integrity perspective. And then as you always see with these new developments you see a small number of very talented open minded dynamic pedagogues, teachers, pedagogues learning how to integrate this. But I know from my previous roles I know that's a small percentage of professors that can do that, and we'll want to do that. And a lot of them, the rest of them will either try to get it out of the classrooms or somehow move away from it. And they'll stay like that for years, so I think it's gonna take many years before we get a hold on this. I think universities as institutions are gonna have a hard time coming up with policies that will, in one way allow it to be used in other ways, prevent it from being used because if I were back in my old prior role, this is what we would be working on right now is how are we going to regulate the use? What are gonna be the rules of engagement? What's gonna happen? When you write those policies, you have to be aware that probably 80% of the teachers are not gonna want to or be able to use this in their coursework, and 20% are gonna really want to. And like 10%, half of those 20% are gonna need to and demand to. So it's really hard to get this into a policy space where an institution has made a systematic response to it. But I think that's where I would be looking next is to see how institutions are making systematic responses to this.

Interviewer [00:22:05] So you talked again about integration and how there could be a resistance from teachers to integrate it. So what do you think could be possible challenges to integrate this thing and how do you think it can be integrated and how those challenges can be resolved?

Interviewee #6 [00:22:25] Well, one of the major challenges that has to be addressed is one of the things that we really rely on as a teaching and learning tool is having students write, having them produce content. That's a very important learning step. And so there may be, and I think this just needs to be tested out, there's nothing new about plagiarism. So I always have very writing intensive courses and whenever I have those, if I just ask students to go out and write something and bring it back, I don't know where it came from. I don't know who wrote it. But you can design assignments so that you are integrating, go find your sources and take out the relevant passages and put them in a document and show me those documents and show me how you're taking from those passages and weaving them together into your own documents. So you can design an assignment so that they can write and you can see their writing develop overtime. But it's very hands on and it takes a lot of pedagogy to be able to do that kind of thing versus saying write me 10,000 word paper on X and then it's due on such and such a date and I'll just read it and tell you give you a number and we're done. When you have stepwise processes, and ChatGPT is the same, like you can say I want you to query ChatGPT these many times and I want you to build a certain stage in the writing process and I want you to take from these passages and synthesize them into something else and start watching step by step, to teach them the writing process. I think these kinds of things can be done, but you can see how

hands on they are. How very much pedagogical design needs to go into them. How a lot of logistical design goes into them? So how do you prevent them from just taking ChatGPT passages and making ChatGPT make another synthesis of it. But I find it just kicks the can forward down the road a little bit. We still have to figure this out in terms of, it's just gotten harder now, but we do need to figure out how to help students learn how to produce content when they don't have to and they can easily not.

Interviewer [00:24:56] There's anything that you would like to add to the conversation, any area that you think our research or maybe future research should look into? Considering the disruptive nature of this thing. And it seems it's gonna influence both teaching and learning.

Interviewee #6 [00:25:31] I would say I would love to hear about the results of your study because it sounds very interesting and very timely. One of the things that I think is most interesting is that question you asked about the disciplinarity of it, because I think to get a better sense of that will help people and universities and institutions kind of help them respond to this in a way that's a bit sensitive to that one issue.

Interviewer [00:26:03] Yeah, we would love to share the findings of our research with you and pretty much everyone who's been a part of this research. So yeah, thank you so very much for the interview, for all the insights that you shared and it's a different perspective because so far we interviewed the teachers, but now it's coming from someone who have the teaching background, but now more into this administrative or you know pedagogy side. So yeah, thank you very much.

Interviewee #6 [00:26:35] Thank you and best of luck with the rest of the study.

Interview #7 - Transcript

Interviewer [00:00:11] I am doing my masters in technology management and this interview we are doing for our project semester thesis which is on ChatGPT and understanding the role how it can improve or have an impact on education as such because most universities are banning it. So can I start with some questions?

Interviewee #7 [00:00:39] Absolutely. Shoot.

Interviewer [00:00:40] So could you tell me about yourself, a brief introduction about which courses you teach, which is your discipline? What background?

Interviewee #7 [00:00:50] I have kind of a meandering background I've been teaching. I got my first teaching job in 1997 as a music teacher. But a few years later, I realized that I needed to learn about technology and education. The principal at the time got a computer for every classroom and no one knew what to do with them. So teachers figured out that I knew where the power button was, so they started asking me questions. So I found that I really enjoyed working with faculty, so I got my masters and instructional technology back in 2003. I was really excited because that's really when the Internet around 2000 is when the Internet really started making its way into classrooms and into schools. And I thought, oh, this is going to be disruptive, this is really going to change what we're doing in school. So now it's really exciting. I was like. technology's gonna change everything, and it didn't. Schools just made the technology fit into what they were already doing and allowed for some allowances and some

accommodations. But schools were very good at continuing to maintain a transmission model of learning and control of the learning. Not really student centered learning, which there's been a lot of discussion around student centered learning over the last ten years or so. So it's starting to make its way in, but not a lot has changed and I was really excited about the pandemic, how that was majorly disruptive and that was going to change and people were gonna realize, Oh my gosh, you really can do a lot online. You really can do a lot remotely. And teachers worked really hard and some of them had a little bit of a paradigm shift realizing that it's OK to give up control because I can't really control what these students are doing in their homes, and even if I require them to have their cameras on, doesn't necessarily mean that they're paying attention to me. So I have to make this more about them. So there have been some changes since the pandemic, but still, education really is continuing on in the way that it's been continuing on. In 2003, after I got my masters, I started teaching adult education. Then pretty soon taught at the university as an adjunct instructor in computer science. I found that I was using a lot of the same teaching strategies that I grew up with. And I hadn't really figured out how to change what I was doing in the classroom until I really learned about the flipped classroom model. Where I put more of the learning in the hands of the students and then I was there as the guide, guiding them through what they were doing to learn. So that's what I really see my role as now is as a facilitator. And I am once again excited and hopeful. I think it's just that I am an eternal optimist, that when ChatGPT finally landed, we've had AI in education for a while, but it's been exclusive. It's only been schools that can afford the tools or that have a research partnership with someone that's developing an intelligent tutor. But it hasn't been widespread and it hasn't been immediately accessible by students until ChatGPT was launched and now suddenly students have access to all of this. And this is another major disruption and I'm not sure that the schools are really gonna be able to survive without making some kinds of paradigm shifts. Schools are really good K through 12 and higher Ed are really good at maintaining that traditional model despite all of these major disruptions. So right now I teach computer applications. I also teach educational technology to pre-service teachers. So this is really going to change the way that I will teach them. I teach them in the fall. And this past year, you know when ChatGPT came out at the end of November, the last couple weeks of class, I asked them to kind of play around with it and we had explored a couple of things around VR and simulations and AR and stuff like that. But it wasn't really a big focus of the class. But now this semester it's definitely gonna change the way I teach, like, day one I will be having them download edge and start using Bing. And I will not be having them create all their own lesson plans anymore. Instead, I want them to develop the right kinds of prompts to ask Bing to create the lesson plans for them. And then I want them to critique the lesson plans. I want them to explain. These activities, how are they going to help the learner? So I also teach them about how learning happens. So based on what you know about how learning happens, how is this activity going to help the student or what changes would you make? So that's kind of where I am now. I'm only teaching part time. I'm a full time doctoral student. But I'm still very active in educational technology and both K through 12 and higher Ed.

Interviewer [00:07:23] That's amazing to hear. And as you already said that now classrooms are not structured in these 4 walls, it's expanded. Also the COVID and ChatGPT have disrupted it. Could you talk more about how do you see the future of education and universities be transformed because you also talked about how schools try to fit these technologies into their curriculum but with ChatGPT a lot of universities are banning it so as a professional person in this education field, how do you navigate this?

Interviewee #7 [00:08:04] Well, industry is also gonna drive some of the change too, because there's already massive changes in the workplace based on AI. It was IBM, Google and some other people

have made massive layoffs because they are going to have AI do a lot of the basic kinds of work that people were doing there. There was a piece on 60 minutes back in I think January introducing ChatGPT and there was a professor from Stanford, he was a law professor and he said ChatGPT is not going to replace lawyers, but it's going to replace lawyers who don't use ChatGPT. That's going to be the way that I think things are from now on is that we're going to have to be AI literate and we're going to have to teach students to be AI literate. So that's a new literacy just like digital literacy was new in the last 20 years. We didn't teach only students that were taking business classes or computer science classes would learn anything about computers or typing. But now ISTE has the standards for students on digital literacy and. Now we're going to have to have a set of standards on AI literacy, and that's going to be something that's going to be the responsibility of K through 12 schools and higher Ed. And it's going to take a while before that becomes codified into law. Not all states have standards that they use, most states in the US use the Common Core standards. The state of [state name], which is where I am, we use the Common Core, but we also have some of our own developed state standards and teachers do have the competencies for teachers, but they also have to meet the ISTE standards as well for teaching with technology. I'm sure ISTE is going to be updating their standards to include AI. So when that happens, we're gonna have to teach teachers about AI. But there is no mechanism like that for higher Ed the faculty because of academic freedom, they can teach whatever they want, and they could teach it however they want. And if they're on tenure track or they receive tenure, there's nothing you can do to change it. You can maybe. Have them teach different classes. Where they won't have an impact on students and have adjuncts teach classes instead who are AI savvy, but it's really gonna come from the students doing things differently because they have so much access to AI and they're going to learn about it on their own, and then it's going to filter in from industry demanding that that students have the competency to use AI efficiently for work. So I think there's going to be some change. Higher Ed and K12 are gonna resist it though.

Interviewer [00:11:46] The news talked about how students have to use it because a lot of universities are saying it's unsafe for academic integrity. People are copying and copyright issues. So how do you think this will impact the students? Because for them it's all about the learning, right?

Interviewee #7 [00:12:03] When the Internet became pervasive around the turn of the century, people were afraid of all of the terrible things that could happen to children. And computers were banned in a lot of places. They didn't want students to cheat, looking up the answers. They didn't want them getting access to porn. There were a lot of reasons why they controlled access to computers. And there was a big industry developing filters. So finally, schools allowed computers, but they put filters on everything so students couldn't access everything. There's now an emerging industry on tracking things that were generated by AI, so that's going to become another industry too, where schools are gonna want to know our students using AI. But the students are going to learn it on their own. So what do we want them to learn? If we wanna shape what it is that they learn, we need to be doing the teaching. Not just letting them explore on their own. So I think it's a responsibility of K through 12 and higher Ed to include AI in our teaching so that we teach students responsibly how to use it. So we acknowledge, yes, you can cheat, you can have AI make these things, but you're not learning. So here's how learning happens. You know, with some things that you need to struggle through because learning is hard, so those things, let's not use AI for that. But when we just need to save time and have AI help us either with brainstorming or with menial kinds of tests, let's use AI for that. And let's think critically about the output of AI because we're going to start seeing a lot more artificially generated content in the media, online, social media and the news. And we're gonna have to figure out that I really see the Pope and a puffy jacket. Was that real or was that generated? So it's going to become a super important skill for students to be able to evaluate what they're seeing. And they're not going to

be able to figure a lot of that stuff out if they don't understand how the AI works, if they are not able to generate those things themselves.

Interviewer [00:14:42] That is so true because I spoke with another professor and she talked about how we should not use this for creativity purposes because then it kind of hinders and slows down your creative thinking process. Do you kind of agree with that?

Interviewee #7 [00:15:00] To an extent. So there is a danger in becoming over reliant on AI just like with calculators, a lot of people reach for a calculator rather than doing the calculations in their head. But if you don't do calculations in your head, you start to lose those basic math facts that you learned. And if you don't have those then numbers don't make as much sense to you anymore. It also takes a lot more brain power to then do anything with numbers. So by having those basic things, it speeds up your thinking and allows you to do other things. So that's really where AI can help offload some of the things that we don't need to be spending our energies on. It can help us be creative because it could spark ideas that we might not have thought of before. And creativity is not actually generating brand new things. It's finding new ways to put old things together. So. I think it can be used for creativity, but the students have to have some basic knowledge in order to understand what it is that they're putting together and what the AI is putting together for them. So I'm not against using it for creativity.

Interviewer [00:16:33] So in your discipline of education, how do you think this will play a role? Particularly in your discipline, because also people who are into tech, they know how to write proper prompts and utilize ChatGPT effectively, but a lot of people in different disciplines struggle with it. So here comes equity and digital division, so what's your thoughts about that?

Interviewee #7 [00:16:57] Yeah. The class is actually called digital literacy and technology in school, so they really need to develop their own digital literacy and that now includes AI literacy. So I really want the students to understand these things so that they can use them as teachers and they can guide their students too. So. It will change the nature of what I teach, and it will change the nature of how I teach because I don't want them to be afraid of AI, and I don't want them to have an adversarial relationship with their students where it's like trying to catch them out in using AI. Instead, I want them to have to develop collaborative relationships with their learners, where the students learn to trust them and they learn to trust their learners so they learn how to use AI effectively. to help students learn. it's another tool in the toolbox.

Interviewer [00:18:11] So how is your method of teaching? I know you talked about it previously, but could you elaborate on how your teaching method in your university and your style and how this tool ChatGPT will help you or maybe be a disadvantage?

Interviewee #7 [00:18:30] So I use a lot of problem based learning where I don't frame the course in terms of here's the content you're gonna get. Instead, I look at, how am I preparing you to solve problems? And what problems are those going to be? So you know the problems of education that they need to solve? How do I help students master these standards? How do I help them engage in learning so that they want to learn and that they want to continue to learn? How do I develop trusting relationships with my students? How do I uncover my own biases and my students biases? How do I meet the individual needs of my students because they're so different and varied. So I frame things around problems. So that's going to continue. So now one of the problems will be how do I help my students use AI ethically for learning and efficiently for learning. So I framed things around problems that you know, really invite them to get engaged with the content so that they have an investment in what it is that they're learning. And then I provide them with a lot of structured materials and some

unstructured play time. So like I give them some very guided things like going step by step through some stuff. But then I also give them like, here are these sites, go and explore them and spend some time, you know, learning how to use this tool or that tool, you know, so there's kind of a combination of both. I also have them work collaboratively a lot. So even though this is an asynchronous online class. They do almost all of their assignments with partners or small groups, so they do it either asynchronously. A lot of them will find times to meet up online synchronously, either through chat or in zoom or something like that. Because I think that they learn as much from each other as they do for me. That's kind of my approach with them. I also want them to learn to use data to understand what's happening, So I collect a lot of data on them and I share that with them and I want them to learn how to collect data on their students to understand what's working, what's not working.

Interviewer [00:21:30] Makes sense. So coming to how this will affect the quality of education going forward as well as for the students? Because you are actually teaching the educators who will now go back and teach their students, right? So how do you think this thing will effects both the learning as well as the teaching?

Interviewee #7 [00:21:52] Yeah. I think If we don't include AI, the quality of teaching and learning is going to decrease. Because it's human nature to find the easiest path. We all do it, even people who like me. I'm working on my dissertation. I love learning. I'm gonna seek out more learning and stuff. I'm gonna look for shortcuts and so will our students. So it's reasonable that they would use a tool to help them with their assignments. But what they need to learn is how learning happens and whether they're helping or hurting their learning by using that tool in that way. So if we don't do that then they're going to start leaning more on the shortcuts and not learn as much. And if we don't start changing the way that we assess students then you're not going to know whether it was the student that performed the work, or if it was an AI that submitted whatever it was that they submitted. So a really good practice is to take whatever assessment you're using and submit it to ChatGPT or to Bing and see what it comes up with and if the AI can complete your assessment and do well with it, you probably need a different assessment. So you need something that is going to challenge the learners in a different way. You want students to be able to do things that I can't do. So that's something that's part of AI literacy, too, is understanding what can and what it can't do. And we want students to understand that.

Interviewer [00:24:04] So we are coming to the end of my questions and I just wanted to understand how do you see the future of education be changed? I know you talked about it, but do you think there will still be a digital divide between people who know how to use prompt or who have access to AI and who learn a lot of that and people from social sciences or politics who have no idea how these things work, so they cannot effectively utilize the benefit that it offers?

Interviewee #7 [00:24:50] So just like we saw with the digital divide, we see the technology haves and have nots and we started seeing that you know in the 2000s. But it was really magnified in the pandemic when we saw how many students just don't have access to broadband Internet or don't even have a device in the house that can do the assignments that they need to do. And a lot of that is tracked with demographics of low income or minoritized or disabled students that are already at a disadvantage. They're further put at a disadvantage because of the digital divide. There will be an AI divide as well, where students who are not given the opportunity to explore AI efficiently, effectively and ethically. They're going to be at a disadvantage in their learning, but they're also going to be a disadvantage in life because they'll be more susceptible to fake news. They won't necessarily

understand what's real and what's not. They won't be able to get good jobs. There's a lot that they will be missing out on. it will be a big problem if we don't. If we don't start using AI in teaching.

Interviewer [00:26:22] Thank you so much. This is a really great insight to us. Just one last question before we wrap up. Do you think I agree with it, it will not replace teaching, but do you feel that there are some professors who already feel that it will replace me and then they are not using it? So any comments about that?

Interviewee #7 [00:26:43] If it can replace you, you weren't doing a good job. So if all you are doing is transmitting information to students, AI can do that and we don't need you. But if you are developing relationships with students, if you are understanding what their needs are, if you are understanding how to teach in a way that is most beneficial for them, those are the things that AI can't do. And those are the things that it's gonna be really hard for AI to learn how to do those things. AI is gonna have to make leaps and bounds in development before it's gonna be able to do those kinds of things. And those are the kinds of things that really make a good teacher.

Interviewer [00:27:33] Yeah, that is so true. Is there anything else you would like to add or discuss before we conclude this interview?

Interviewee #7 [00:27:42] I don't think so, but are you aware of the future trends forum?

Interviewer [00:27:48] The future?

Interviewee #7 [00:27:48] Yeah with Brian Alexander, future trends forum. So Brian Alexander is a thinker in the future of higher education. He has these forums every week on Thursdays at 2:00 PM Eastern Time. So the one this week is on AI in Higher education. So he will be talking with Brent Anders and Ruben Puentedura. Brent has been writing a lot about AI in higher education. He's got a book called ChatGPT AI in education and then Ruben Puentedura runs Hippasus. There's a lot in AI in education, but the way that these forums work is that there's a stage where the speakers are on, but then anyone in the audience can come up on the stage and talk and ask questions. And there's a chat that you can use and stuff. It's very interactive. But you might enjoy attending that one.

Interviewer [00:31:23] Thank you so much. Yeah, this would be really a good resource.

Interviewee #7 [00:31:27] Yeah and I actually just interviewed Brent for our podcast. So I'm in AECT which is the Association of Educational Communications and Technology. So it's research association and instructional design and technology. We have a podcast on learner engagement and our last episode was with Brent Anders, where he talks about AI literacy.

Interviewer [00:32:12] Ok, I will check that out. Thank you so much for taking the time. This was super nice.

10.4. Appendix E - Validation

10.4.1. Communication with Key Findings

Here are the key findings of our study, after analyzing the data generated by the survey and the interviews with regards to the selected theories and the literature review.

10.4.2. Current Usage Patterns and Use Cases

- Adoption and usage of LLMs like ChatGPT align with the diffusion of innovation theory, with higher usage among innovators and lower usage among laggards.
- Survey revealed that while only 15% of the sample reported having poor or very poor knowledge about ChatGPT and similar tools, a considerable proportion of 35.8% indicated that they rarely or never utilize them.
- Participants in the survey possess at least a moderate understanding of LLMs, but there may be various factors influencing their adoption and usage patterns, even among those who are knowledgeable about these tools.
- The relationship between knowledge and usage of LLMs follows a logarithmic trend, with an increase in usage as knowledge increases, but a decrease at higher levels of knowledge compared to a linear progression.
- Concerns related to plagiarism, over-reliance, and accuracy are among the primary reasons hindering individuals with knowledge about LLMs from using them.
- ChatGPT is utilized in various academic settings, serving as a tool for text generation, analysis, summarization, and research assistance. It aids professors in generating discussion materials, brainstorming sessions, literature reviews, data analysis, and writing research papers. It also assists students in creating shorter versions of texts and supports language translation for communication in diverse student populations.
- The versatility of ChatGPT reflects a shift toward active and student-centered education, generating personalized content, facilitating discussions, and supporting learners in crossing their individual zone of proximal development.
- The use of LLMs aligns with principles of connectivism and social constructivism, as they provide a comprehensive source of information, facilitate dialogue-based learning, and enable self-inflicted scaffolding.
- However, current learning theories like connectivism and social constructivism are not fully equipped to analyze education in the context of intelligent tools like ChatGPT. An updated theoretical framework is needed to address the unique characteristics and impacts of these technologies in education.

10.4.3. Discipline Specific Effects

- The influence of ChatGPT in higher education varies depending on the discipline, with greater impact observed in disciplines that emphasize written work, such as social sciences and humanities.
- In disciplines like computer science, ChatGPT is extensively used by students for generating code, replacing the need to search specific websites for assistance.
- Plagiarism concerns and approaches differ across disciplines, with efforts to integrate ChatGPT into assignments in social sciences and humanities while the focus is less on plagiarism in STEM fields.
- The adoption of ChatGPT is reshaping practices related to information literacy and citation, prompting discussions on the absence of an authoritative voice and the need to consider contextual elements in ChatGPT-generated content.

- The survey data suggests a correlation between the discipline of study and the percentage of students attributing a specific role to ChatGPT (or similar tools).
- Survey showed that students view LLMs like ChatGPT primarily as intelligent collaborators in general, but there are variations across disciplines. Social Sciences and Health Sciences students perceive these tools more as an Instructor, while Humanities students see them as both an Intelligent Collaborator and Feedback Provider. Engineering and Technology students view them less as a Feedback Provider and Intelligent Collaborator but more as an Instructor.
- Discipline-specific approaches are important for integrating LLMs effectively in education, taking into account the different perceptions and influences across disciplines and addressing individual challenges accordingly.

10.4.4. Change in Quality of Learning and Teaching

- LLMs, such as ChatGPT, are perceived positively by students due to their ability to act as comprehensive and intelligent sources of information, providing personalized support and serving as navigators through vast networks of knowledge.
- The survey results show a consistent positive perception of students regarding learning quality when using LLMs, regardless of the teaching method, with slightly higher results for the flipped classroom model.
- Students primarily use ChatGPT for seeking help with homework, obtaining research assistance, and receiving support with essay writing, indicating its usefulness for educational support and productivity enhancement.
- The research findings indicate a combination of optimism and caution regarding the long-term effects of ChatGPT on education. While some believe it can enhance learning and skill development, others express concerns about declining learning quality and reliance on ChatGPT for assessments.
- Integration of ChatGPT into education is emphasized, with a focus on teaching critical evaluation skills, promoting AI literacy, and encouraging students to make informed decisions about using ChatGPT effectively.
- Human supervision, critical thinking, and the adoption of problem-based learning models are highlighted as crucial elements in evaluating AI-generated content, combating biases, and ensuring the quality of instruction.
- The overall findings suggest that while students appreciate the benefits of LLMs, there is a need for careful consideration of the risks and negative effects. A focus on lifelong learning and a comprehensive understanding of the limitations and biases of LLMs can contribute to improving education in conjunction with these technologies.

10.4.5. Other Insights and Recommendations

Teacher-Student Interaction and Methods of Teaching

- Interviewees discuss incorporating ChatGPT and AI into teaching methods to promote interactive and personalized learning, highlighting potential benefits for students, especially in large class sizes.

- Concerns are raised about AI replacing teachers, emphasizing the unique qualities and relationships that teachers bring to the learning experience.
- Effective teaching strategies, such as problem-based learning and flipped classroom models, are mentioned as approaches to engage students and develop skills.

Assignments, Assessments and Grading

- The reliance on written assignments in ChatGPT affects assessment and grading in education, raising concerns about cheating and the authenticity of student work.
- The use of ChatGPT pushes teachers to reconsider their approach to assessment and teaching, emphasizing the need for authentic assessment methods.
- The challenges of assessment and the pressure to return to traditional methods like handwritten exams are discussed, highlighting the need for assessment practices that support diverse learners and align with workplace skills.

Academic Integrity and Ethical Issues

- Plagiarism and copy-paste practices existed before ChatGPT, but AI technologies have increased the need to address them. Therefore, acknowledging and citing the use of AI is important in academic work.
- Not all generated output can be directly copied, as AI technologies can produce hallucinated or nonexistent content as well as produce biased content.
- Critical evaluation of AI-generated content is a valuable skill as artificially generated content becomes more common.

AI Awareness and AI Literacy

- AI literacy and awareness are essential for the effective use of AI tools in education. It should be a part of education to prepare students for the future.
- Training teachers on AI is crucial for promoting a better learning experience.
- AI should be used as a tool to enhance learning, not to replace critical thinking.
- Balancing AI and human control is important, with humans remaining in control and collaborating efficiently with AI.

Guidelines, Policies and Challenges for Integration

- Developing policies and regulations for the use of LLMs is complex due to resistance to change and differing levels of adoption among teachers.
- Establishing guidelines and policies requires significant effort and may face obstacles in committee discussions.
- Liability and accountability for the actions of LLMs are unclear, highlighting the need for sophisticated policies.
- Banning LLMs is not seen as a viable solution; instead, collaborative engagement is encouraged.

AI Divide, Inequity and Inclusion Challenges

- The widespread adoption of LLMs like ChatGPT has the potential to widen inequalities instead of reducing them. The potential of ChatGPT to breach inequities exists, but its current use does not align with reducing inequalities.

- Students who are already comfortable with English and technology may benefit more from AI tools, while those struggling with language and lacking access to technology may be limited in their use of the tools or not use them at all.
- Universities have a role in empowering students by providing quality orientations and ensuring they have the knowledge and skills to effectively use technological tools, including AI.

Nature of Disruption and Future Possibilities

- The disruptive nature of ChatGPT and other emerging technologies prompts teachers and professors to reflect on their pedagogy and adapt to new teaching paradigms.
- The technology is viewed as a tool that will continue to refine and evolve, potentially becoming a tool similar to Google but with different functionalities.
- Universities have the opportunity to embrace ChatGPT as a disruptor and leverage it to create efficiencies in administration and refresh the curriculum, but this requires incentives and requirements from accrediting bodies.
- Embracing disruptive technologies like ChatGPT can generate future possibilities for integrating them into education and better preparing students for the job market.