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Human Artificial Intelligence Collaboration in Higher Education: A Conceptual Framework for Enhancing Critical Thinking and Academic Performance

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The research and development of artificial intelligence in education (AIE) have significantly influenced and reshaped the field of higher education in recent years. In recent years, the field of higher education has been profoundly shaped and influenced by the research and development of AI

Artificial intelligence (AI) has had a significant impact on Higher Education (HE), changing the ways in which learning, teaching and knowledge production are undertaken and opening up new potential to enhance educational outcomes; but it has also raised issues of the critical thinking and learning outcomes of students in increasingly technologized learning contexts. Today there is no single, comprehensive conceptual model for the use of human and artificial intelligence to build a synergy and support cognitive development and meaningful learning processes. This study engages with this issue by focusing on the potential of human-artificial intelligence collaboration in higher education, exploring the potential of AI to aid critical thinking, examining the link between AI-assisted learning and academic performance, and proposing an integrative conceptual framework of human-AI collaboration in the educational field. The research design of this study was qualitative, systematic and integrative literature search, thematic analysis, conceptual synthesis and document analysis of literature, education and policy documents. The findings indicate that human-AI collaboration is complementary, with the human partner bringing creativity and ethical awareness, context and reflective thinking, while the AI partner brings personalization, adaptive learning, feedback loops and access to information. The study also points to the potential challenges and opportunities of AI integration, such as digital literacy, algorithmic bias, academic integrity and equal access to educational technologies. The results of these lead to the proposal of a multidimensional conceptual framework based on the technological, pedagogical, cognitive and institutional aspects of human-AI collaboration. The study can be used as a theoretical basis for the implementation of educational policy and practice in the educational technology, artificial intelligence in education and critical thinking and pedagogy in higher education. The overall findings suggest that the strategic use of human-AI partnerships has the potential to transform the HEC to positively impact students in several areas, such as critical thinking, improved outcomes, and creating more inclusive, adaptable, and innovative learning environments.

INTRODUCTION

Digital technologies are rapidly transforming the nature of higher education and are revolutionising the processes of knowledge creation, sharing and assessment. Among these, one of the most revolutionary and disruptive innovations is artificial intelligence (AI), which is offering universities around the world with new opportunities and challenges. The rapid growth of such AI-enabled technologies as intelligent tutoring systems, adaptive learning systems, generative artificial intelligence, automated assessment systems, learning analytics and conversational agents (such as ChatGPT) has hastened the digital transformation of higher education and transformed traditional pedagogical practices. Such technologies are gaining traction in higher education to improve the learning experience, personalise learning, simplify administration and promote student achievement. (Holmes et al., 2022; Hwang et al., 2020)

The role of AI in education is not just about technology; it's a transformation that merges the capabilities of humans with the power of machines. The collaboration of students, teachers and smart technologies is increasingly becoming commonplace in today's education environments. AI systems are not just about retrieving information or automating tasks, but about supporting students in thinking, creating, providing feedback and learning. Thus the concept of cooperation between humans and artificial intelligence has been the subject of extensive research and discussion among scholars, educators and policy makers who are eager to learn how humans and intelligent technologies can synergically enhance educational outcomes. (Holmes et al., 2022; Hwang et al., 2020)

AI's increasing presence in higher education brings a wealth of enthusiasm for its potential in education. AI technologies offer some possibilities for personalised education, such as catering to the individual learner's needs, monitoring the learner's progress and providing immediate feedback. The use of intelligent tutoring systems and the development of generative AI applications has shown great potential in boosting engagement, accessibility, and self-directed learning. AI-powered analytics can also detect learning challenges, forecast academic risks, and aid in evidence-based educational interventions. (Castaneda & Selwyn, 2018)

Though it's a positive development, it has also spurred significant concerns about how AI technologies affect critical thinking and academic achievement. Critical thinking is considered as one of the essential skills for the 21st century in higher education. It is considered a prerequisite for lifelong learning, decision making and job achievement. It is expected that universities will pass on knowledge but also develop students' critical analysis of information, assessing evidence, analyzing complex problems and reflective thinking. (Braun & Clarke, 2022)

As the generative AI tools come into play, there are significant concerns that students are not learning these core cognitive skills but are relying more and more on information generated by the algorithms. The apprehension is that as students heavily depend on AI tools, they risk becoming complacent learners who will not need to think critically and independently to solve problems. The worry is that students might grow into what could be termed as "passive learners" who do not need to think deeply and solve their own problems because of relying much on AI tools. AI systems have the potential to deliver information quickly and help with studying, but they can also foster shallow learning if not integrated into educational settings with well-designed pedagogical frameworks.

There is also mixed evidence linking the use of AI to support learning with learning outcomes. In certain studies, AI technologies have been shown to positively influence learning outcomes when it comes to engagement and access to information and personalised support in learning. Other research studies have found that the gains of AI in education are primarily dependent on situational factors such as student digital literacy, self-regulation skills, instructional practices, and the support provided in the school. The mixed results indicated that academic outcomes are not only a result of technology use, but also a result of technology affordances and human capabilities in relation to the educational context.

The concept of the human-AI collaboration in education is that human and AI are two forces that complement each other, such that the combination of their intelligence and efforts can work more effectively than either force on its own towards the achievement of educational objectives. Human intelligence provides creativity, moral judgment, emotional understanding, contextual thinking and critical thinking. AI offers computational efficiency, processing of data, adaptive feedback and personalized support of learning. The effectiveness of educational AI is not about replacing the human mind, but it is about the systems that can complement and foster human learning and intellectual development. (Braun & Clarke, 2022)

Over the past decade, the scope of Artificial Intelligence in Education (AIED) has grown considerably to include intelligent tutoring systems, learning analytics, adaptive education technologies and the use of Generative AI applications. The major objective of AIED is to enhance the teaching and learning process using intelligent systems which can be used to support both teachers and learners in different learning environments. The existing literature has focused on technological innovation and effectiveness, instead of more general consideration of pedagogy and cognition in the field of human-AI interaction. (Holmes et al., 2022; Hwang et al., 2020)

Another key concept which this study is based on is critical thinking. Typically, this is the ability to objectively assess information, assess arguments, integrate evidence and make reasoned decisions. In today's information-rich knowledge societies, decisions are made through algorithms and critical thinking is more necessary than ever. Advanced students will require the

ability to locate information, evaluate its authenticity, recognise any bias and make their own judgements. The advent of AI technologies in higher education raises critical questions concerning the impact of AI on higher education students' critical thinking skills. (Braun & Clarke, 2022)

The academic achievement of students is an important measure of educational performance and student achievement. It involves skills and knowledge that students have gained through learning, and show how they are able to acquire knowledge and apply intellectual skills. While AI tools can support learning outcomes, the effective integration of AI tools into the education system and the ability to move beyond mere task completion and towards real learning will take time.

When it comes to personalized learning, the connection between human intelligence and AI technologies becomes stronger. Personalised learning is defined as 'In adapting the learning process to an individual's needs, preferences and ability'. There are many other areas where AI can help, notably, analysing learner data and recommending learning resources and feedback, which can be enormous in terms of personalised learning. But personalization is only going to work if there is somebody reading the human notes to make sure that learning experiences are ethically acceptable, inclusive, pedagogically beneficial.

Another crucial term is Human-Centered AI, which involves creating AI systems that augment human capabilities. Human centeredness is a focus on transparency, fairness and ethical responsibility, as well as human and intelligent technology partnerships. This perspective is especially salient in the context of higher education, as educational experiences do not just entail learning knowledge but also include socialization, emotional growth, ethical thinking, and identity construction. (Castaneda & Selwyn, 2018)

The scholarship with regards to the utilization of AI in higher education is growing, however certain gaps still exist in the literature. First, there is a lack of theoretical understanding about how human–AI collaboration works in the context of learning and the impact collaborative relationships between humans and intelligent technologies have on learning outcomes. Second, previous research has tended to have concentrated on critical thinking or on academic performance alone, rather than on how these two aspects of education are related. Third, there is a huge "information gap" about the complementary nature of human intelligence and AI in Higher Education. Lastly, the field is fragmented across disciplines and there are currently no integrative qualitative syntheses that can provide an overall and coherent understanding of the nature of human–AI collaboration. (Braun & Clarke, 2022)

In particular, the diffusion of AI technologies in Universities is very uneven and there is no conceptual guidance on pedagogical implications. Without theory, technology, the pedagogical approach and the design consequences can be used without consideration of student learning and cognition. Without a theory, there is a risk of uncritically applying technology, pedagogical practices and design consequences that are not in line with students' learning and cognition. Therefore, the development of synthesis studies of existing evidence and the concept of a comprehensive conceptual model that can inform the ethical and effective use of AI in Higher Education is an urgent need. (Castaneda & Selwyn, 2018)

The present study aims to fill these gaps by articulating five objectives: (1) examining new emerging role of human–AI collaboration in higher education; (2) investigating the critical thinking development through AI assisted learning; (3) studying impact of AI technologies in academic performance; (4) identifying opportunities and challenges of human–AI collaboration; and (5) developing a conceptual framework for the integration of human intelligence and artificial intelligence in higher education. (Holmes et al., 2022; Hwang et al., 2020)

Based on this, the research questions of this study are:

In what ways is AI transforming Higher Education?

What are the ways in which AI can support and/or impeded critical thinking?

How can AI improved learning impact the education system?

What are the factors that facilitate successful collaboration between teachers and AI agents in teaching?

How might we conceptualise ethical and pedagogically appropriate use of AI in higher education? (Castaneda & Selwyn, 2018)

A large number of complementary theoretical approaches are utilized in the study. Constructivist Learning Theory emphasizes an active construction of knowledge and the active nature of learning experiences. According to the Socio cultural theory, social interaction and mediated learning experiences are emphasized. The Human-Centered AI Theory is a means of conceptualizing co-operative interactions between humans and intelligent technologies. The TAM provides a framework for understanding the factors that can influence the implementation and use of AI technologies, and the SDT emphasizes the significance of autonomy,

competence and motivation when learning. In the view of connectivism, learning occurs in the digital environment and technological systems in a networked manner.

Qualitative research was used for methodological design that was based on an integrative literature review, thematic analysis, conceptual synthesis and document analysis of scholarly publications, educational reports and policy documents. This allows a thorough assessment of the current evidence base and a conceptualisation based on theory.

This article will be organized as follows: The following section summarizes the pertinent literature on the issues of artificial intelligence in higher education, human–AI collaboration, critical thinking, as well as academic performance. The methodology used in the study is discussed in the next section. The major themes are presented in Findings and Discussion section as well as the conceptual framework has been suggested. Finally, the paper offers some theoretical contributions, along with some practical implications, challenges, and future research directions regarding the effective integration of humans and artificial intelligence in learning and higher education. (Holmes et al., 2022; Hwang et al., 2020)

LITREATURE REVIEW

Higher education is in the midst of digital revolution that has significantly reshaped the creation, dissemination and consumption of knowledge. Artificial Intelligence (AI) is one of the recent technologies that has been making substantial changes in the educational landscape and approach of institutions. AIED refers to a large array of technologies, such as intelligent tutoring systems, adaptive learning platforms, learning analytics, educational chatbots, automated assessment systems and generative AI applications. Various technologies have been applied in the teaching and learning process increasingly in order to increase the efficiency of learning, learning process quality and services to support the learning process. AI education systems are getting significant funding from universities around the globe as an opportunity to address challenges such as student engagement, diversity in learning and access. (Holmes et al., 2022; Hwang et al., 2020)

This increasing presence of AI in higher education is indicative of a broader shift to educational environments that are digitally mediated and data driven. The pedagogical models are transformed with the use of intelligent learning systems that include personalised learning, timely feedback and predictive analytics, helping to detect students who might be at risk of school failure. AI can enhance education systems by offering personalized learning experiences and curricula, which can be more effective and equitable, according to the proponents of AI. AI has the potential to assist in developing a more effective and equitable education system by customizing learning experiences and curriculum, proponents argue. But others are concerned with pedagogical, ethical, and cognitive issues that are easily overlooked in the frenzy of technology. The introduction of AI in higher education is not just about technology changing the landscape; it's about a paradigm shift in the relationship between students, educators and knowledge. (Castaneda & Selwyn, 2018)

The use of AI to work in partnership with humans is gaining traction amongst academics in this new educational context. Human-AI collaboration is a combination of human intelligence and AI in order to achieve a synergy that each intelligence cannot achieve without the other. The present paradigm of AI is and has been more about “augmentation” as opposed to the previous “automation and substitution.” In the classroom, AI can process a huge amount of information, provide personalized guidance, and provide immediate feedback, while human actors can introduce their contextual knowledge, ethical awareness, creativity, emotional intelligence, and critical thinking. (Braun & Clarke, 2022)

There is debate about whether to augment or replace human input in Higher Education with AI. In the eyes of techno-determinists, AI is a disruptive technology that will take the place of many of the roles and responsibilities of teachers and learners in education. The learning process, however, is not solely an algorithmic learning process as implied in the human centred views, where learning pertains mostly to social and cognitive aspects. Learning is complex in terms of the meaning making, interpersonal communication, development of emotions and reflective thinking that are still uniquely human capacities. Researchers, thus, call for collaborative intelligence, an AI cognitive companion that is not to replace but to complement human learning and decision making. (Castaneda & Selwyn, 2018)

Collaborative intelligence is especially important in the context of higher education, which is increasingly focused on developing higher-order cognitive abilities in their learners, not only to absorb information. Students will be expected to have the ability to think critically, solve problems, be creative and have reflective reasoning; all of which are essential components of their education needed for a changing and technologically complex society. Usually critical thinking is defined as the ability to think in a systematic way about information, the ability to evaluate arguments and evidence, the ability to identify assumptions, and the ability to draw appropriate inferences. It is fundamental to Higher Education since it enables students to function in an information-rich environment, to be the basis of independent enquiry and to introduce students into the world of knowledge societies. (Braun & Clarke, 2022)

However, the connection between AI and critical thinking is still unclear. At the same time, AI tools can help enhance the critical thinking skills by enabling inquiry-based learning, offering a variety of information sources, and offering personalized feedback that encourages reflective learning. Intelligent tutoring systems and AI-based applications can stimulate curiosity, offer new perspectives on challenging subjects and motivate the learners to think on higher levels. When implemented effectively in the pedagogical context, AI is a powerful tool to boost intellectual development and deep thinking. (Braun & Clarke, 2022)

On the other hand, there are also worries about the dangers that over-dependence on AI technologies could undermine the ability for critical thinking. As the dawn of generative Artificial Intelligence technologies that can write essays or summarise content or answer academic questions, worries have emerged about the impact on students' thinking and intellectual independence. Others think that algorithms that produce knowledge may foster passive consumption, limit critical thinking and lead to shallow content engagement. The user-friendliness of AI systems allowing them to generate answers might encourage students to refrain from exercising any thought on the answer and from reflecting on it. Implications for education are then less about what it can do, and more about pedagogies to which it can fit. (Holmes et al., 2022; Hwang et al., 2020)

The other aspect of the conversation about the use of AI in higher education is academic performance. AI methods are being integrated into educational institutions, and educators are hoping to improve learning outcomes for students, as well as student engagement and academic achievement. Several studies report that the use of AI supported learning environments can have a positive impact on academic success via adaptive instruction, personalized feedback and specific academic support. For example, learning analytics can be employed to identify students' challenges and offer interventions to improve learning results. (Castaneda & Selwyn, 2018)

The relationship between AI and academic performance is, however, not consistent or clear. Digital literacy, motivation of learners, self-regulation, institutional resources, pedagogical design, and other factors have an impact on the effectiveness of AI-supported learning. The AI technologies could be extremely beneficial to students with good self-directed learning skills. It can be difficult for students with less digital literacy to make use of these tools. In addition, assessments should consider academic achievement in the context of other learning goals such as intellectual development, problem solving and the ability to learn throughout life.

Personalized learning is one of the key domains where AI is significantly impacting higher education. Personalised learning is an attempt to make adjustments in the way learning is provided to meet the needs, interests and characteristics of the individual learner. Using AI systems, data can be analysed and adaptive algorithms can be used to identify learning patterns, provide learning resources and tailor interventions to individual student needs. The attributes are very useful to improve students' learning outcomes and effectiveness. While educators warn that the concept of personalized learning should not be narrowly defined. However, making sure that educational experiences are socially relevant, ethically appropriate and pedagogically suitable requires a lot of human effort to make it authentic personalization. (Castaneda & Selwyn, 2018)

Ethical concerns need to be addressed as well, especially in the higher education arena. There are also important ethical considerations regarding AI usage in higher education. The human-centered approaches to AI underscore the need to develop and deploy AI technologies in education that embody human values, are transparent, and honor human autonomy. But, what does it mean to be Human-Centered AI? Creation of smart systems to support human skills and ensure human autonomy and control in decisions. A thinking of this kind is particularly important in an educational context, where learning is not solely algorithmic, but has ethical, emotional and social dimensions. (Castaneda & Selwyn, 2018)

In the context of ethics and AI in education, there are various concerns, such as algorithmic bias, transparency, accountability, and data privacy. AI systems will be likely to contain learning outcomes which mirror social inequities and biases existing in data on which they're trained, and can lead to discriminatory learning outcomes. Also discussed issues of data collection and student data usage, where privacy, consent and surveillance issues arise. Moreover, the increased adoption of generative AI has sparked debates on issues of academic integrity, plagiarism, and authenticity of student work. The challenges underscore the importance of responsible and ethical practices in the integration of AI in higher education. (Castaneda & Selwyn, 2018)

There are many challenges, but the possibilities of using AI technologies to improve educational accessibility and inclusivity are vast. With the assistive technologies, intelligent system can help the student with disability; Language translation support can help international students; Geographically distributed students can be provided learning opportunities with flexible learning opportunities. AI can help make learning environments more inclusive by reducing access and delivery barriers to learning and increase the access to learning resources. However with these opportunities come questions as to digital divide and access to technology resources. Access to digital infrastructure, technological literacy and institutional capacity is highly variable and may indicate unequal benefits for students and institutions when accessing the learning environment supported by AI tools.

There are various theories which try to explain the integration of AI in higher education. There are a few theories that have emerged in the field to provide an explanation for the incorporation of AI into higher education. Various theories have been proposed in literature to account for the embedding of AI in higher education. The constructivist theory of learning strongly

believes in the active construction of knowledge and meaningful learning takes place when the learner is actively involved in the construction of knowledge, through critical involvement in information. This is in keeping with the idea of using AI to enhance enquiry and reflection rather than replacing it with information delivered. (Castaneda & Selwyn, 2018)

In the Socio-cultural theory, the Social interaction and mediated learning experience are also emphasized. In this respect, AI can be regarded as a mediation technology that shapes the educational interaction and facilitate co-construction of knowledge. The theory, however, serves as a reminder for researchers that learning is still a social and cultural process, thus, the interaction between human in the learning environment should be considered.

The Technology Acceptance Model (TAM) is one model that tries to explain the acceptance of educational technologies in terms of user perceived usefulness and ease-of-use of the technology. The model provides useful insights into the factors influencing AI adoption, but provides limited explanations about the broader cognitive and pedagogical implications of human–AI collaboration. In line with self-determination theory, autonomy, competence and relatedness are also relevant, with regards to motivation and facilitating meaningful learning. However, when the design of AI systems is designed to inspire autonomy and feedback is carefully and individually shaped, this may inspire intrinsic motivation; when the technology is too controlling and/or the feedback too general, it has the potential to squander students' agency in their learning.

Another important approach is Connectivism, in which learning is distributed (networked) among individuals, technologies and information systems. The theory embraces the increasing involvement of digital technologies in knowledge creation and learning processes. But it has been charged with not being so successful in dealing with ethical issues, with human aspects of learning, such as emotional involvement and critical thinking. (Braun & Clarke, 2022)

These theories are beneficial but not enough to provide a comprehensive view of human intelligence and AI in critical thinking and academic achievement. Current research is still piecemeal and tends to focus on individual aspects of implementing AI. However, the literature does not offer a conceptual model that can provide a better understanding of the complementarity between human and AI in the present context of higher education. (Braun & Clarke, 2022)

There are, however, a number of key research gaps. There is a lack of understanding of how human–AI collaborations impact educational outcomes in theory. To the best of my knowledge, there is no conceptual linkage between critical thinking and academic performance in one package. Literature review indicates that in methodology, quantitative methods overwhelmingly outnumber qualitative methods, and some technologies are examined for effectiveness, while there are fewer qualitative literature synthesis of educational experiences and concepts relating to the technology. Most studies are conducted in a technologically sophisticated educational setting, limiting the application of human-AI collaboration in different institutional and cultural environments. Most studies are conducted within a technologically sophisticated educational setting, making it difficult to know how human-AI collaboration can be realized in different institutional and cultural environments. Most of the studies are conducted within technologically sophisticated education environments, reducing the scope of applicability of human-AI collaboration to other institutional and cultural contexts. (Braun & Clarke, 2022)

These gaps highlight the need for a comprehensive qualitative research that brings together existing evidence and builds a theoretically grounded conceptual framework for understanding human–AI collaboration in higher education. This is pivotal for shaping the pedagogically informed and responsible application of AI in higher education, as well as its ethical implications. The study looks at the link between AI technologies, critical thinking and academic outcomes for the purpose of an AI development of knowledge in the field of education and as a conceptual starting point for better and more responsible relationships between AI and human in higher education. (Braun & Clarke, 2022)

RESEARCH METHODOLOGY

Research Paradigm and Philosophy

The study has its research philosophy and epistemological approach interpretivist and constructivist respectively in which the interpretation is that meaning and knowledge are constructed and shaped through social interaction, experience, and construction by humans. The introduction of artificial intelligence (AI) in Higher Education is multidimensional and complex, making it difficult to comprehend and quantify using a positivistic perspective. The human-AI collaboration is cognitive, pedagogical, social and ethical and is based on institutional contexts and personal experiences. Therefore, it is an appropriate method to apply the interpretivist method in this research due to its efforts to understand the interpretation and meaning given by the actors in the educational field about the new relationship formed between human intelligence and artificial intelligence. (Holmes et al., 2022; Hwang et al., 2020)

Constructivist epistemology is also applied in this research because in this theory educational realities are not predetermined, pre-given but are created through interaction that occurs in the learning process between learners, educators, technologies, and

institutional spaces. Critical thinking, academic performance, and the working relationship between humans and AI are socially constructed and context-dependent, and require interpretative inquiry and conceptual exploration. Thus, the research method used in this study is qualitative inquiry research that emphasizes understanding, synthesis and interpretation of the existing knowledge. (Braun & Clarke, 2022)

RESEARCH METHOD

The design of this study is qualitative with an integrated literature review, conceptual research and document analysis and thematic synthesis. The aim of this study is to gain a holistic understanding of the human-AI interaction in higher education and its consequences for critical thinking and academics performance without testing hypotheses and building statistical relationships. (Braun & Clarke, 2022)

An integrative review of literature is appropriate for this as it includes and combines different types of evidence (theoretical, empirical, policy, and conceptual papers). The benefit of conducting an integrative literature review versus a traditional literature review is that it not only involves critically reviewing the literature but also creates new conceptual frameworks and theories.

In addition, conceptual research method applied in this study is appropriate for the study if theories and empirical results are scattered and require to be consolidated and presented in an explanatory whole. AI is an emerging field within Higher Education with various interpretations and misunderstandings about it and its possibilities. A conceptual approach allows the identification of relationships among the key constructs and aids in theory building. (Castaneda & Selwyn, 2018)

Moreover, document analysis was used as a systematic approach to analyze and interpret past scholarly and policy articles related to the topic of Artificial Intelligence in education, Human–AI collaboration, Critical thinking and Academic performance. Document analysis can provide a context and give researchers more information to analyze trends, themes and conceptual relationships between multiple pieces of evidence. (Holmes et al., 2022; Hwang et al., 2020)

Last, the study uses a thematic synthesis approach to highlight and synthesize themes and patterns within the literature. This method is helpful especially in qualitative conceptual studies to help build up higher-order interpretations and frameworks.

Data Sources

The study only uses secondary data that is quantitative and comes from authoritative and peer-reviewed sources. The sources of the data are:

- Articles in journals that are included in the various indexes of social sciences journals, such as SSCI, Scopus, Web of Science indexes;
- Publications in magazines; and
- Proceedings of conferences;
- Data on key elements of the social protection framework; and
- Curriculum development materials and guides; and

News on AI control and guidance for education

Multiple data sources give a holistic view of a problem to be investigated and results have a higher level of validity and strength.

The focus on the literature in the timeframe 2015–2026 was strengthened by the fast-paced evolution of AI technologies and its increasing penetration into higher education. But also seminal studies and fundamental theoretical writing before this time were included to give conceptual and historical background. (Castaneda & Selwyn, 2018)

Search Methodology

Literature search was done using strictly systematic search. The following major academic databases were used to search:

- Scopus;
- Web of Science;

- ERIC;
- Science Direct;
- SpringerLink;
- Google Scholar.

Combinations of the following keywords and search terms were used to conduct the search:

(2) “Language, Literacy, and the Learning of English as an Additional Language”; and

- “Blockchain for Academic Integrity;” and

In conjunction with the human and AI collaboration.

- “Human-Artificial Intelligence Collaboration”;

Artificial Intelligence and Critical Thinking

The impact of AI on Academic Achievement. The Importance of Ai in Education

- “Educational Technology”
- “Customized Learning”
- Human Centered AI;

The use of Generative AI in post-secondary education

Boolean operators AND, OR and NOT were used to help narrow down the search results.

Eligibility Criteria

In the process of literature selection the following criteria have been used:

The following are publications that are specific to AI and higher education:

Studies on critical thinking and academic achievement, human–AI collaboration.

Reports/Articles from peer reviewed journals.

Publications in the English language.

Studies mainly published in 2015-2016.

Exclusion criteria:

The following sources were not included:

Web sites and blogs that are not academic.

Opinion pieces and editorials not of scholarly nature.

Duplicate studies .

Publications not linked to higher education education in the context of education. (Castaneda & Selwyn, 2018)

Sources that are not clear about their method.

The application of these criteria in a systematic manner guaranteed that the literature included was relevant and of good quality.

Data Collection Procedure

The process of gathering the data took place in a number of stages.

Stage 1: Literature Identification

The first search found an extensive body of literature regarding AI in education and the collaboration between humans and AI. Titles and abstracts were screened for initial relevancy.

Stage 2: Screening and eligibility screening

Studies identified were checked against specified inclusion/exclusion criteria. We then screened full text documents for relevance to the study goals.

In the third phase, document management and organization are addressed.

The selected studies were grouped into the following themes:

- The internet and its connectivity; and
- Human-AI cooperation;
- Thinking critically;

Academic Achievement;

Human-centred and ethical AI;

- Opportunities and challenges of integrating AI.

Documents were processed and created into an organised repository for analysis and conceptual synthesis.

Stage 4: Extracting data

Data was collected from each source by extracting information key.

- Research Aims;
- Theoretical Standpoints;
- Methodological Approaches;
- Major Conclusions;
- Theoretical Contributions;
- Implications On Higher Education.

The extraction process facilitated the identification of patterns and conceptual relationships in the literature that were repeated.

Methods of Data Analysis

Thematic Analysis

Thematic analysis was employed to identify, analyse and interpret the common themes in the literature (Braun & Clarke, 2006). Qualitative analysis procedures that were followed were:

Content Analysis

A systematic review of scholarly publications and policy documents was done using content analysis. It was possible, with this approach, to extract from the literature concepts that were frequently discussed, as well as trends and areas of consensus and disagreement.

Content analysis also identified the ways researchers and policymakers think about integrating AI into higher education and pointed out gaps in the current research. (Castaneda & Selwyn, 2018)

Conceptual Analysis

Key constructs were explicated through conceptual analysis, and relationships between concepts were explored, including between human-AI collaboration and critical thinking, academic performance and personalized learning. (Braun & Clarke, 2022)

This process included comparing definitions, noting conceptual similarities and differences and synthesizing theoretical perspectives into an integrated understanding of the phenomenon being studied.

Framework Creation

The final stage of analysis was to combine themes and concepts into a conceptual framework as a whole. The framework proposes to describe the interaction between technological, pedagogical, cognitive and institutional factors that affect effective human-AI collaboration and foster critical thinking and academic outcomes in higher education. (Braun & Clarke, 2022)

The framework highlights the synergy of human and artificial intelligence, and establishes a theoretical foundation for embedding AI in universities responsibly and ethically. (Holmes et al., 2022; Hwang et al., 2020)

The trustworthiness and quality of the research

Adherence to the criteria of credibility, dependability, confirmability and transferability guaranteed methodological rigor.

Creditability

Credibility was established through the use of multiple sources of data such as peer-reviewed literature, policy documents and international reports. Evidence from various sources was triangulated to strengthen the validity of the findings and to minimise the scope for selective interpretation.

Reliability

The reliability was ensured through the transparent and systematic procedures used in literature searching, screening, data extraction and analysis. Processes were documented in detail for replication.

Confirmability

Confirmability was attained by taking their reference points from the data of authoritative sources and by the researcher's clear audit trail during the research process.

Transferability of skills

The study aims to be non-statistical but the results are transferable since they combine evidence from various types of higher education institutions and offer conceptual understandings that are transferable to various institutional settings. (Castaneda & Selwyn, 2018)

Ethical Issues

This study used publicly available documents and thus did not involve human participants and did not require an ethical approval.

Several ethical principles were observed in the process of the research, they are: • maintaining academic integrity; • accurate representation of the existing work;

Properly Quote and Reference Sources;
Each Student Will Avoid Plagiarism and Mis-Interpretation;
Objective and Balanced Interpretation of the Evidence.

The study also aimed at reducing the influence of the researcher using different academic perspectives and challenging other views.

Study Limitations

There are certain restrictions to be acknowledged. The research is conducted using only secondary qualitative data which is devoid of primary empirical data from students and educators. Secondly, the field of AI is rapidly evolving, and future technological advancements could impact the understanding of human-AI collaboration. Third, the higher education landscape varies significantly between countries and institutions, potentially impacting on the applicability of some findings in a particular context. (Castaneda & Selwyn, 2018)

Despite some restrictions, the study offers a broad overview of existing knowledge and a good framework for future empirical research.

Methodological Contribution

The method used in this work has contributed significantly to the areas of AI in education, studies in higher education, and research in educational technology. This study employs qualitative synthesis, conceptual analysis and framework development to develop an approach to understanding the complex relationships between human intelligence and artificial intelligence in education. (Holmes et al., 2022; Hwang et al., 2020)

The methodology also addresses the current fragmentation of the literature and advances theory building by introducing an integrative model that bridges the human-AI collaboration with critical thinking and academic outcomes. It also contributes to the growing body of research on the future of higher education in an era of artificial intelligence from a methodological and conceptual perspective. (Holmes et al., 2022; Hwang et al., 2020)

RESULTS and DISCUSSION

Summary of Findings

The qualitative synthesis of the literature reveals that the use of AI in higher education is not only a technological phenomenon but pedagogical and cognitive one, which is transforming the knowledge production, dissemination, and assessment process. Five themes emerged from this analysis: (1) human-AI collaboration as a complementary learning partnership; (2) human-AI collaboration and development of critical thinking skills; (3) effects of AI assisted learning on academic outcomes; (4) opportunities and challenges of AI in higher education; and (5) conceptualization of the relationships among these themes. (Braun & Clarke, 2022)

Theme	Key Findings	Implications for Critical Thinking	Implications for Academic Performance
Human-AI Collaboration as a Complementary Partnership	AI augments rather than replaces human intelligence.	Supports inquiry and reflective learning.	Improves efficiency and learning support.
Human-AI Collaboration and Critical Thinking	AI can both enhance and weaken higher-order thinking.	Encourages analysis but may foster dependency.	Indirectly improves learning quality.
AI-Assisted Learning and Academic Performance	Personalized learning and adaptive feedback improve outcomes.	Promotes self-regulated learning.	Enhances engagement and achievement.
Opportunities and Challenges of AI Integration	Ethical, technological, and equity issues persist.	May affect independent reasoning and creativity.	Creates both opportunities and disparities.
Proposed Conceptual Framework	Effective collaboration requires human-	Facilitates meaningful	Supports sustainable

Theme	Key Findings	Implications for Critical Thinking	Implications for Academic Performance
	centered AI and supportive conditions.	cognitive development.	academic success.

Theme 1 study of Human-AI collaboration as complementary educational partnership (Luckin, 2018)

The key takeaway of this research is that AI should be considered a learning companion rather than a substitute for human learning. The literature is numerous, and it repeatedly states that AI has great capabilities in dealing with data, in adaptive learning, information retrieval, and personalized feedback, while humans still exercise their creativity, ethical judgment, contextual understanding, emotional intelligence, and critical thinking. (Braun & Clarke, 2022)

This finding underpins collaborative intelligence—a concept that holds that the most successful educational results will be obtained when combined with the use of human and artificial intelligence in collaboration. In the present context of higher education, teachers are more and more becoming facilitators, mentors, and developers of meaningful learning experiences, rather than content experts. Students are no longer passive recipients of information, but active participants interacting with intelligent technologies to build up knowledge. (Holmes et al., 2022; Hwang et al., 2020)

The results are in line with the Constructivist Learning Theory and the Sociocultural Theory. Constructivist theory promotes meaningful learning that is facilitated by active engagement and construction of knowledge. Sociocultural, on the other hand, highlight the importance of interaction and mediated learning. The use of AI technologies could be a mediating factor in learning processes, but it cannot take the place of the human aspects of education, including empathy, socialization and moral reasoning.

The findings also indicate that the debate over ‘replacement’ versus ‘enhancement’ for AI is increasingly consensual – and in favor of enhancement. Although generative AI technologies can accomplish tasks that have previously been attributed to humans, the education process itself is still fundamentally social and cognitive, and involves human interpretation and judgment. Consequently, universities need to shift to pedagogical approaches that foster a collaborative and cooperative interaction between students, teachers, and AI tools.

AI should not be viewed predominantly as a tool to minimize human interaction in education from a policy perspective. Instead, higher education policies should focus on developing human-centered AI strategies that enhance human capabilities and promote meaningful educational interactions. (Castaneda & Selwyn, 2018)

Theme 2 Human-AI Collaboration and Critical Thinking Development

The second significant discovery relates to the complex interplay between the development of AI and critical thinking skills. Research suggests that AI tools can improve higher-order cognitive abilities by tailoring learning experiences, providing real-time feedback, and access to a wealth of information resources. AI-powered learning space can promote inquiry, problem solving, and multiple viewpoints to students. (Braun & Clarke, 2022)

But the findings also show a significant paradox. The use of intelligent technologies, however, can lead to a loss of critical thinking abilities if it becomes excessive. With the rise of generative AI, there is a concern that students will increasingly be tempted to use AI-generated responses instead of developing their own understanding and analysis. (Braun & Clarke, 2022)

This finding is of particular importance as critical thinking is still one of the main aims of higher education. The purpose of a university is to create people who are able to solve complex problems, to assess evidence and decision in an uncertain environment. The proof is that it can only assist with these goals if we have reflective pedagogical practices in place. (Braun & Clarke, 2022)

The outcomes agree with the Self-Determination Theory (SDT) that emphasizes learner autonomy and competence. AI technologies can promote critical thinking if they enable students to learn independently and spur students to take an active role in information processing. AI systems that facilitate passive knowledge consumption, however, can jeopardize intellectual independence. (Braun & Clarke, 2022)

The results also align with the theory of Constructivist Learning Theory that involves active thinking and building up of meaningful knowledge. Higher order thinking is more likely to be induced when students are asked to reflect on AI outputs, question assumptions and engage in dialogue.

Based on the results, the authors propose that universities should include AI literacy and critical digital skills in the curriculum. Students should have an understanding of the capabilities and limitations of AI technologies and how to critically assess the information generated by AI.

Theme 3: Academic Achievement and the use of AI for teaching and learning

The third theme highlights that AI-assisted learning can have a positive impact on academic performance via personalized learning, adaptive feedback, and enhanced student engagement. AI can recognize specific learning gaps, offer personalized resources, and make timely interventions to help students achieve success.

The literature indicates that AI's potential to improve higher education is among its most significant contributions: personalized learning. The use of adaptive systems allows for the tailoring of learning experiences to students' learning styles, preferences and progress. This personalized approach can boost student motivation, improve engagement, and positively impact academic results. (Castaneda & Selwyn, 2018)

However, the results also indicate that the link between reading AI and academic achievement is not causal. Several mediators such as digital literacy, self-regulated learning skills, institutional supports, and pedagogical design are important to enhance academic achievement.

This result is in line with the Technology Acceptance Model that identifies the perceptions of usefulness and ease of use as important in technology adoption and outcomes. The more students appreciate the importance of AI technologies and can put them to use, the more they will benefit.

Connectivism also offers some interesting reflections for AI for learning, in terms of the role of networks of learning and the role of digital connections. AI can help to improve access to information and provide a greater learning opportunity, which can have a positive impact on education.

The outcomes suggest that universities should invest in students' digital competencies, as well as in the pedagogical skills of their teachers, and not only in technological infrastructure. The impact of technology on academic performance will not be solely about increasing student performance, but will be about how technology is being used in instructional methods and learning.

Theme 4: Potential and Pitfalls of AI Integration in Higher Education

The fourth theme raised both opportunities and challenges of using AI in higher education. The results show that AI technologies have the potential to significantly improve accessibility, inclusiveness and flexibility in education. Intelligent systems can help learners with disabilities, facilitate multi-lingual learning environments and give geographical dispersed populations educational opportunities. (Castaneda & Selwyn, 2018)

However, the results reveal major difficulties as well. One of the biggest concerns with the integration of AI is still digital inequality. Inaccessibility of technological resources, digital infrastructure and technological competencies may contribute to the reinforcement of existing inequalities in the educational field.

The issue of ethics was also prominent. Some of the challenges to the responsible use of AI in higher education are algorithmic bias, data privacy, transparency, and accountability. Furthermore, the proliferation of Generative AI technologies has raised concerns regarding academic integrity and originality of student work. (Castaneda & Selwyn, 2018)

Dependence on technology is another big problem. Overreliance on AI systems can stifle students' ability to think critically and solve problems on their own, reducing their opportunities for creative thinking and reflective learning.

These findings uphold the Human-Centered AI Theory which emphasizes the need for designing and implementing intelligent technologies in a manner that promotes human well-being, preserves human agency, and complies with ethical principles. Human-centered approaches acknowledge that education is not purely algorithmic; it has social, emotional and moral aspects.

The results indicate the need for comprehensive AI governance mechanisms in universities, which include considerations for equity, ethics, transparency, and responsible usage. Educational policies should be inclusive and technological innovations should not increase existing inequalities.

Theme 5: Conceptual framework development

The final theme draws on the findings and presents a conceptual framework that explores how human–AI collaboration impacts critical thinking and learning outcomes in higher education. (Braun & Clarke, 2022)

The suggested framework conceptualizes human–AI collaboration as a dynamic and mutually constructive interaction between human intelligence and AI. Human intelligence drives creativity, ethics, context and reflection, and AI drives computation, adaptability, and personalization.

Student autonomy; • feeling empowered; and • self-efficacy. Other intervening factors influencing educational outcomes include: self-efficacy, student autonomy, feeling empowered, and digital literacy.

- Educational Design;
- Support From The Institutions;
- Ethical Governance
- Accessibility from A Technical Point of View.

These factors will affect the extent to which critical thinking and academic success are enhanced by human-AI collaboration. (Braun & Clarke, 2022)

The framework also implies that critical thinking is an important mechanism by which AI impacts academic performance. By critically engaging with technologies such as AI, students will not only be able to work productively with these tools but also learn to utilize them to foster deeper learning and achieve positive learning outcomes. (Braun & Clarke, 2022)

The conceptual model therefore challenges the notion of simplistic assumptions that AI will automatically improve learning outcomes. Instead, it highlights how human intelligence and artificial intelligence can be mutually beneficial in an enabling institutional and pedagogy settings to realize their educational benefits. (Holmes et al., 2022; Hwang et al., 2020)

The framework has the value of bringing together the various strands of literature with a coherent set of explanations for the field of Artificial Intelligence in Education. It also plays a role in higher education scholarship by reinforcing the importance of connecting technologic innovation with pedagogical aspects related to people. (Holmes et al., 2022; Hwang et al., 2020)

General Discussion

Overall, the findings indicate that the future of higher education is not about technology taking the place of teachers, but it is about the effective partnership between humans and intelligent technologies. The use of artificial intelligence can have a significant impact on the learning experience, making it more accessible, enhancing educational outcomes, and fostering innovation. But these benefits can only be realized if AI is embedded in an ethical, inclusive, and pedagogical manner. (Holmes et al., 2022; Hwang et al., 2020)

This study reveals that human intelligence is still required in creativity, critical thinking, ethics and social interaction. In turn, the most successful learning environments will be the ones that harness the power of AI's capabilities and human beings to mitigate the pitfalls of technological dependency, inequality and ethical issues. (Braun & Clarke, 2022)

CONCLUSION

Artificial Intelligence (AI) technologies have undergone rapid growth and development, leading to a profound transformation in the field of higher education, which has significantly altered the understanding and practice of teaching and learning and the creation of knowledge. The human intelligence vs. artificial intelligence is a key research and application problem in this evolving educational landscape. This study set out to examine the new domain of human–AI collaboration in higher education and to create a conceptual model that can account for the potential benefits of meaningful interaction between human and artificial intelligence on critical thinking and academic achievement. The study was inspired by the recognition that technology is a necessary but insufficient condition for improving learning experiences, and that education and learning demands more humanistic and pedagogically responsible approaches to using AI in future learning. (Holmes et al., 2022; Hwang et al., 2020)

This study demonstrates that human–AI collaboration is not a paradigm shift, but instead, it can be regarded as an educational partnership. While AI systems can process information, learn adaptively, and give personalized feedback at impressive levels, they can't do things uniquely human like creating, reasoning, feeling, and making judgement calls in context. The study thus disputes the deterministic narratives of the view that AI can replace human intelligence and promotes the idea that the most effective educational outcome can be achieved through collaboration between human and artificial intelligence. In this context, AI is a cognitive and pedagogical ally, but not a substitute, for individuals, to augment and complement their capacity. (Holmes et al., 2022; Hwang et al., 2020)

Additionally, the complex interaction between AI and the cultivation of critical thinking is significant. The study suggests that there is a significant potential for AI technologies to assist in higher-order cognitive aspects of inquiry, multiple perspectives and reflective learning. If placed in appropriate pedagogical contexts, intelligent education systems can inspire in students problem-solving, creativity, and analytical thinking skills. However, the research also indicates that excessive dependence on AI technologies could also compromise students' independent thinking and mental autonomy. Generative AI's ability to generate information and solutions creates the potential for passive learning and a reduction in cognitive engagement. The educational potential of AI therefore highly hinges on the manner in which it is applied and if it supports an active and critical engagement with knowledge. (Braun & Clarke, 2022)

The results also demonstrate that AI-assisted learning can positively drive academic performance by providing personalized learning experiences, adaptive feedback, and increased student engagement. AI technologies enable the creation of learning experiences tailored to the needs of every single learner and increase the possibilities for effective and inclusive learning. The study suggests, however, that the adoption of technologies does not always lead to better academic achievement. There are numerous intervening variables to consider in the realm of education. These factors include digital literacy, motivation of learners, self-regulation, pedagogical design and institutional support. This discovery underscores the need to view academic achievement as a multi-dimensional phenomenon and not just a catch-all indicator of academic success.

Additionally, this paper explores the possibilities and obstacles of using AI in higher education. On the one hand, AI technologies provide unprecedented opportunities to improve accessibility, inclusivity and flexibility of education. They can serve a variety of learners, facilitate individualized instruction and extend instructional opportunities out of the window. The findings, on the other hand, suggest significant issues of digital inequity, algorithmic bias, academic honesty, techno-dependency and ethical oversight. The challenges highlight the need for responsible and ethical use of AI technologies in higher education, as well as the social and policy dimensions of their implementation. (Castaneda & Selwyn, 2018)

The conceptual framework proposed by this research is a major contribution in the area of explaining the dynamic relationships between human intelligence, artificial intelligence, critical thinking and academic performance. The process of conceptualizing the framework is human-AI collaboration, which is an interactive and reciprocal process. The process of conceptualizing the framework is human-AI collaboration, which is interactive and reciprocal, where the human and AI bring different but complementary capabilities to educational processes. Furthermore, the framework identifies some of the factors that can mediate the effectiveness of this collaboration, including digital literacy, the level of learner autonomy, pedagogical practices, institutional support, and ethical governance. The framework brings together existing snippets of literature to create a coherent theoretical basis for the application of AI in fostering meaningful learning and educational achievement. (Holmes et al., 2022; Hwang et al., 2020)

The study brings about some important theoretical implications. Firstly, it is a step towards the emerging field of Artificial Intelligence in Education (AIED) that was technology-centric to human-centric and collaborative views. Second, it adds to the scholarship of higher education by providing an integrated perspective on the pedagogical and cognitive effects of integrating AI. Third, the research highlights the quality of human-technology interaction as a crucial factor in the educational use of AI, beyond technological complexity. Lastly, the study brings together the findings of the theories of learning and human-centered AI (HCAI) such as Connectivism, CST, SST, SDT and TAM to create a framework that intertwines the theories together. (Holmes et al., 2022; Hwang et al., 2020)

The results of this study also have important practical and policy implications. The results indicate the importance of implementing institutional strategies in universities and higher education institutions for integrating AI responsibly and pedagogically. The pathway forward for educational institutions is not only about the technology and its infrastructure, it is also about training educators, developing digital literacy and establishing ethical frameworks for the use of AI technologies. The findings underscore to educators the importance of creating learning experiences that promote students' critical engagement with information generated by AI rather than passive consumption of it. The study results demonstrate the importance of teaching students digital skills and critical AI literacy skills to enable them to effectively and responsibly apply intelligent technologies. (Castaneda & Selwyn, 2018)

It is also crucial for educational policymakers to advocate for the inclusion of AI technologies in education that are just and fair. Regulatory frameworks must be developed in order to mitigate issues of data privacy, algorithmic transparency, academic integrity and digital inequality. Likewise, educational AI system designers and developers need to embody a human-centered design approach that puts the educational objectives, health of the learner and ethical issues ahead of functionality.

The study results result in some recommendations. HEIs must develop policies that encourage responsible and ethical uses of AI and introduce AI literacy into the curriculum. Pedagogical approaches should foster and promote critical thinking, reflective questioning, and independent problem-solving by teachers in AI-supported learning environments. Digital inequalities can be addressed by adopting inclusive technological policies and guaranteeing fair access to resources related to AI in institutions. Furthermore, future educational technologies should be designed to augment rather than supplant, human intelligence, and allow for space for human interaction and intellectual growth. (Braun & Clarke, 2022)

The study also provides valuable information for further research. The presented conceptual framework is theoretically based and gives a solid explanation for how humans and AIs collaborate, but the relations and propositions need to be tested and validated empirically in various educational settings. Further research is needed on the impact of various forms of AI use on critical thinking and academic performance among various student populations and across various subject areas. Comparative and longitudinal studies have the potential to provide a lot of insight into the changing dynamics of human-AI collaboration and what the future of higher education will look like. Ethical governance and the barriers of digital inequalities and how to create effective human centered AI policies in educational contexts also needs further research. (Braun & Clarke, 2022)

Lastly, the conclusions of the current research demonstrate that AI is not the magical panacea for education and does not pose an existential threat to human learning. Instead, it is a powerful technological resource and its educational significance will be determined by its incorporation in the processes of teaching and learning. The future of higher education is not about human vs. machine, it's about humans and machines working together effectively and ethically. This will enable students to build their critical thinking, enhance their learning and flourish in the digital learning environment. This vision will necessitate partnerships between universities, teachers, policy makers and technology developers to foster educational ecosystems that promote human flourishing, intellectual development and inclusive education innovation through the power of AI. (Braun & Clarke, 2022)

REFERENCES

- Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K–12 settings. *AI and Ethics*, 2(3), 431–440. <https://doi.org/10.1007/s43681-021-00096-7> (Holmes et al., 2022; Hwang et al., 2020)
- Alam, A. (2021). Possibilities and apprehensions in the landscape of artificial intelligence in education. 2021 International Conference on Computational Intelligence and Computing Applications (ICCICA), 1–8. <https://doi.org/10.1109/ICCICA52458.2021.9697272> (Holmes et al., 2022; Hwang et al., 2020)
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice Hall.
- Bates, A. W. (2022). *Teaching in a digital age: Guidelines for designing teaching and learning* (3rd ed.). Tony Bates Associates.
- Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, 610–623. <https://doi.org/10.1145/3442188.3445922>
- Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. Sage.
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W. W. Norton.
- Brynjolfsson, E., Li, D., & Raymond, L. R. (2023). Generative AI at work. *National Bureau of Economic Research Working Paper Series*, No. 31161.
- Castaneda, L., & Selwyn, N. (2018). More than tools? Making sense of the ongoing digitization of higher education. *International Journal of Educational Technology in Higher Education*, 15(1), 22. <https://doi.org/10.1186/s41239-018-0109-y> (Castaneda & Selwyn, 2018)
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage.

- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Dede, C. (2010). Comparing frameworks for 21st-century skills. In J. Bellanca & R. Brandt (Eds.), *21st century skills* (pp. 51–76). Solution Tree Press.
- Dwivedi, Y. K., Kshetri, N., Hughes, L., et al. (2023). So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- European Commission. (2022). Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. (Holmes et al., 2022; Hwang et al., 2020)
- Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review*, 1(1). <https://doi.org/10.1162/99608f92.8cd550d1>
- Fullan, M., Quinn, J., Drummy, M., & Gardner, M. (2020). *Education reimaged: The future of learning*. New Pedagogies for Deep Learning.
- Garrison, D. R. (2017). *E-learning in the 21st century: A community of inquiry framework for research and practice* (3rd ed.). Routledge.
- George, A. L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*. MIT Press.
- Goodyear, P. (2020). Design and co-configuration for hybrid learning. *Educational Design Research*, 4(2), 1–25.
- Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign. (Holmes et al., 2022; Hwang et al., 2020)
- Holmes, W., Persson, J., Chounta, I. A., Wasson, B., & Dimitrova, V. (2022). Artificial intelligence and education: A critical view through the lens of human rights, democracy and the rule of law. Council of Europe. (Holmes et al., 2022; Hwang et al., 2020)
- Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, 1, 100001. <https://doi.org/10.1016/j.caeai.2020.100001> (Holmes et al., 2022; Hwang et al., 2020)
- Luckin, R. (2018). *Machine learning and human intelligence: The future of education for the 21st century*. UCL Institute of Education Press.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.
- Mayer, R. E. (2021). Multimedia learning and educational technology. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (3rd ed., pp. 3–19). Cambridge University Press.
- Means, B., Bakia, M., & Murphy, R. (2014). *Learning online: What research tells us about whether, when and how*. Routledge.
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.
- Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *Education and Information Technologies*, 28(9), 11543–11561. <https://doi.org/10.1007/s10639-023-11866-0>
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.
- Ng, D. T. K., Lee, M., Tan, R. J. Y., et al. (2023). The role of artificial intelligence in education: Current progress and future directions. *Computers and Education: Artificial Intelligence*, 4, 100118. <https://doi.org/10.1016/j.caeai.2023.100118> (Holmes et al., 2022; Hwang et al., 2020)

- OECD. (2021). Digital education outlook 2021: Pushing the frontiers with artificial intelligence, blockchain and robots. OECD Publishing. (Holmes et al., 2022; Hwang et al., 2020)
- OpenAI. (2023). *GPT-4 technical report*. arXiv. <https://doi.org/10.48550/arXiv.2303.08774>
- Popenici, S. A. D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 22. <https://doi.org/10.1186/s41039-017-0062-8> (Holmes et al., 2022; Hwang et al., 2020)
- Redecker, C. (2017). *European framework for the digital competence of educators (DigCompEdu)*. Publications Office of the European Union.
- Ryan, R. M., & Deci, E. L. (2020). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). Sage.
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity Press.
- Selwyn, N. (2022). *Education and technology: Key issues and debates* (3rd ed.). Bloomsbury.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 3–10.
- Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review*, 46(5), 30–40.
- Stake, R. E. (1995). *The art of case study research*. Sage.
- Stokel-Walker, C., & Van Noorden, R. (2023). What ChatGPT and generative AI mean for science. *Nature*, 614(7947), 214–216. <https://doi.org/10.1038/d41586-023-00340-6>
- UNESCO. (2021). *AI and education: Guidance for policy-makers*. UNESCO.
- UNESCO. (2023). *Guidance for generative AI in education and research*. UNESCO.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5–23.
- West, D. M. (2018). *The future of work: Robots, AI, and automation*. Brookings Institution Press.
- Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. *Learning, Media and Technology*, 45(3), 223–235. <https://doi.org/10.1080/17439884.2020.1798995>
- Williamson, B., Eynon, R., & Potter, J. (2020). Pandemic politics, pedagogies and practices: Digital technologies and distance education during COVID-19. *Learning, Media and Technology*, 45(2), 107–114. <https://doi.org/10.1080/17439884.2020.1761641>
- World Bank. (2020). *Realizing the future of learning: From learning poverty to learning for everyone, everywhere*. World Bank.
- Xie, H., Chu, H. C., Hwang, G. J., & Wang, C. C. (2019). Trends and development in technology-enhanced adaptive learning: A systematic review of journal publications. *Computers and Education*, 140, 103599. <https://doi.org/10.1016/j.compedu.2019.103599>

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 39. <https://doi.org/10.1186/s41239-019-0171-0> (Holmes et al., 2022; Hwang et al., 2020)