ChatGPT: Towards Educational Technology Micro-Level Framework

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Abstract

The study explores the role of ChatGPT in the development of a micro-level framework for Educational Technology (EdTech). This study employed an inductive research design particularly a Constructivist Grounded Theory (CGT) approach from thirty-four private secondary high school teachers in the Philippines. To gather insights from specific participants, a semi-structured interview format was utilized. The instrument went through face validation from two experts well-versed in education research, instrumentation, and three-stage prompts. In addition, using JAMOVI software, *Fleiss' Kappa* was used with a value of 0.715 indicating a substantial agreement among the expert validators. The interviews were designed to be open-ended, allowing for a flexible exploration of the research topic then subjected for data analysis with the aid of QDA Miner lite software. The findings revealed three (3) distinct milieux: pedagogical support, professional development, and ethical sense. In the (a) pedagogical support milieu, ChatGPT emerges as a virtual compass, offering real-time assistance, explanations, and guidance for teachers. It demonstrates the capability to answer questions, clarify concepts, and provide step-by-step support, crafted to individual students' needs and learning styles; within the (b) redesigning milieu, it serves as a catalyst for adapting and recalibrating assessment and teaching strategies to suit learning purpose; and (c) ethical sense milieu highlights various implications, including data privacy, plagiarism, transparency, accountability, and overly reliant to the AI tool. Thus, this paper offers a micro-level framework anchored to the ChatGPT's role in EdTech and aims to stimulate further scholarly discourse in the field.

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1. Introduction

Educational technology (EdTech) today is not merely confined to chalk and board method, but it represents technology-based spectrum of digitization with educational theory designed for enhancing the 21st century skills. More than the tools with theoretical foundations that underpin design and implementation where it meets with pedagogies (Andriole, 2020; Mirrlees & Alvi, 2019), the premise is that a theory provides the framework through which educators comprehend, evaluate, and optimize any technological interventions in education. Concurrently, ChatGPT aims to improve the educational landscape by reinventing interactive support. ChatGPT is a pervasive Artificial Intelligence (AI) tool, its acronym derived from "Chat Generative Pre-trained Transformer," symbolizes a groundbreaking language model by Open AI. From an argumentative perspective, the advent of ChatGPT has changed natural language generation. A quick history drop tells that it is a sophisticated computer program that utilizes the transformer architecture (Montenegro-Rueda et al., 2023; Vaswani et al., 2017). In layman's term, it is designed to mimic and generate human-like conversation, enabling it to engage with users and perform processing tasks like translation, answering questions, and generating sentences based on user inputs and prompts.

Undeniably, ChatGPT emerges as a versatile tool with significant potential for supporting open education by providing feedback for self-directed learners. As such, its ability to recommend fueled learning materials and resources for teachers assists learners in accessing the most suitable information to enhance their knowledge acquisition (Cain et al., 2023). It is worth noting that while ChatGPT already offers valuable educational uses, there are further untapped possibilities for its integration in the future. However, as EdTech continues to expand and redefine how teachers utilize ChatGPT for learning, a noticeable void emerges – the absence of comprehensive theoretical framework that can guide its implementation at the micro-level of education.

A theoretical framework is essential at the micro-level of education as it provides a systematic approach to addressing the complexities of diverse learning environments. It offers guidance, promotes consistency, and helps educators navigate the challenges associated with individualized instruction, classroom management, assessment, and cultural sensitivity. The absence of such a framework can lead to adhoc practices and a lack of coherence in educational strategies, potentially hindering the quality of education at the

micro-level. This prompted the researchers to embark on contributing a framework covering ChatGPT's role in EdTech. This contribution is rooted in the recognition that, while the potential of AI in education is abundant, the lack of well-defined theories serves as an impediment to its realization. Hence, this study provides an overview of the growing significance of ChatGPT as part of EdTech and highlights the need for research exploring the perspectives of high school teachers and introduces constructivist grounded theory as suitable research design.

This study examines the timeliness and relevance of utilizing grounded theory as a research design to investigate the educational applications of ChatGPT in the context of high school education. Consequently, providing a theoretical framework from a grounded theory to educational research focused on ChatGPT, with a specific focused on the perspectives of high school teachers.

2. Literature Review

2.1. ChatGPT as a Subset Useful Tool in Education

The topic of AI is broad; it covers automation, data analytics, changing technological tools, and a variety of applications. The development of AI systems has been aided in part by what are known as large language models (LLMs), which are essentially language-based power chatbots like Google's Bard and Microsoft's Bing Chat. On the other fence, ChatGPT has become famous integral part of various industries, and the field of education is no exception. It can be employed in diverse tasks, from personalized learning and tutoring to language acquisition, research assistance, and even mental health support. Its adaptability and accessibility make it a valuable resource, enabling students and educators to access information and assistance 24/7, regardless of their location or time zone. Furthermore, Haluza and Jungwirth (2023) predict that these megatrends will persist as the twenty-first century advances.

In the field of education, ChatGPT is a useful tool for teachers in a variety of micro tasks and effective research and instructions. For tasks like essays, literatures, and even computational problems, it can be utilized to develop lesson plans. To assist teachers in providing their students with better instruction, ChatGPT offers topic-specific graphics,

activities, and exercises. Teachers can use ChatGPT to offer their students individualized learning support. Depending on the needs and learning preferences of a student, ChatGPT can also provide specific resources and procedural instructional activities. The ChatGPT model's strength can also be used by teachers to grade quizzes and assignments given to students (Rahman & Watanobe, 2023).

2.2. ChatGPT in Relation to Educational Landscape

According to Zhai (2023), the rise of AI has catapulted upheaval in the educational scene directly to the use of ChatGPT in education and opened new possibilities for interactive learning, allowing users to engage in dynamic conversations *vis-à-vis* the AI-powered system. This change is anticipated to have a systemic impact on educational objectives, curricula planning and methods, assessment and learning articulation. The world's educational agenda have changed dramatically over the past ten years, mostly as a result of technological improvements (Grassini, 2023; Neumann et al., 2023). The convergence of AI and education has provided revolutionary possibilities, and ChatGPT stands out as a major participant in this ever-changing field. Because of AI's versatility, accessibility, and responsiveness to individual needs, students and teachers can use it in a varied and inclusive educational context. Mhlanga (2023) claims that integrating ChatGPT when decided by teachers, can aid through providing them with helpful resources and enlightening knowledge that can help them enhance their teaching efficiency. This is in contrast to the argument of Hofer and Grandgenett (2012) that primary obstacles to the effective integration of EdTech in the classroom are external factors that lie beyond the decision of teachers. These external barriers necessitate institutional-level attention and often entail gradual changes.

In macro stance, it is opining that students' learning outcomes and experiences could be enhanced by the use of ChatGPT in educational settings, particularly in developing countries where access to high-quality education is limited (Peres et al., 2023; Qasem, 2023). ChatGPT serves as more than just a mentor or tutor; it becomes a constant source of support and guidance during the learning process and instructional preparations aid (Hwang & Chen, 2023; Ibrahim et al., 2023; Javaid et al., 2023; Seaba, 2023).

2.3. Challenges and Opportunities: Academic Integrity Is at Stake?

Offering promise of enhanced learning experiences, personalized instruction, and access to vast amounts of information, EdTech has undoubtedly opened new horizons in the surface of education. However, the use of AI in education is not without its challenges, one of which is the educational polarization. One side may strongly support the advancement, and the other end spectrum strongly inhibits. However, from bibliometric analysis, it also presents challenges related to depersonalization, potential loss of pedagogical expertise, ethical concerns, and the need to balance standardization and creativity within the educational framework especially when assessment of work is on the line (Montenegro-Rueda, 2023).

ChatGPT poses to more established forms of evaluating written work, like essays, still it is one of the main arguments against using it to grade written assignments. The plagiarism detection tool and paraphrasing tests offered by ChatGPT have good matching rates (Aydn & Karaarslan, 2022). This makes it rather evident that ChatGPT plagiarizes and then writes original content. All of this may constitute "paraphrasing plagiarism," as it is called. Due to the difficulty in identifying instances of plagiarism, some educators are worried (Duha, 2023; Rudolph et al., 2023). Additionally, Lo (2023) advises that teachers be given upskilling on how to use ChatGPT efficiently to distinguish plagiarism in student work. Students are encouraged to determine or balance of ChatGPT's capabilities, limitations, and potential negative consequences on academic integrity.

Educational institutions prioritize the development of critical thinking, research skills, and original thought. According to Mhlanga (2023), the ability of ChatGPT to write essays opens the door for the employment of novel and cutting-edge techniques in educational contexts. Despite of the applaud, AI models can produce biased or unfair results due to the biases present in their training data. This is of great concern in sectors where decisions must be just and equitable. In finance, for instance, AI models can inadvertently perpetuate existing financial disparities. The potential for biases raises questions about accountability and transparency, and it can be difficult to pinpoint responsibility for AI-driven decisions. Also, putting into context, the foremost concern in academia is maintaining academic integrity. ChatGPT can be used to generate essays, answer test questions, or complete assignments, raising concerns about plagiarism and eroding the fundamental values of

academia. Nonetheless, some institutions have thus opted to restrict the use of AI models in student work to preserve academic integrity (Greitemeyer & Kastenmüller, 2023).

2.4. ChatGPT: Future Trends in Education

As ChatGPT rise rapidly for wide audience, it opens a flexible conversational AI model, leading the way to inevitably transform education (Neumann et al., 2023). This can be said that the future of education is set to be shaped by this transformative technology, with a host of emerging trends poised to redefine how students learn, teachers instruct, and educational institutions operate. According to Zhai (2023), AI and ChatGPT are key components of the modern education revolution, with significant ramifications for both talent development and national competitiveness. With the use of these technologies, education will undergo a radical change that would produce future engineers, scientists, and citizens more equipped to satisfy the demands of society (Garcia-Penalvo, 2023; Rummel et al., 2016). Additionally, utilizing AI tools like ChatGPT can promote multi-perspective understanding, recalibrating curricula, and endless talk of discussions in the academe (Seaba, 2023).

The teachers' utilization of technology in the classroom can vary, either encompassing its comprehensive integration into the curriculum or its application to enhance specific lessons. These differences in technology adoption reflect underlying disparities in educators' perceptions of technology's relevance in the educational process. Ertmer et al. (2012) emphasize the alignment between teachers' technology integration practices and their beliefs, indicating that teachers tend to implement technology in accordance with their convictions. These convictions are substantially shaped by educators' philosophies concerning student learning. If a teacher subscribes to the notion that student learning predominantly hinges on direct teacher-led instruction, their classroom practices are likely to be guided by conventional teaching methods.

According to Zhai and Pellegrino (2023), educational objectives are set based on societal demands and must anticipate and educate students for citizenship in the future. AI has become a part of every aspect of society with the introduction of AI technology and programs like ChatGPT. As a result, it is noteworthy education address and provide a solution for the pressing problem of raising future citizens who can adapt to future societal evolution and are skilled in comprehending and utilizing AI technology.

2.5. ChatGPT on the Cusp of Information Generation for Learning

Based on the study of Lund and Wang (2023), the integration of ChatGPT in education has brought about substantial improvements in creative aspect, leading to increased effectiveness and efficiency in educational management particularly preparing for different ancillaries. This application has not only facilitated global learning but also enabled personalized learning experiences, development of more intelligent educational content, and streamlined overall educational process. ChatGPT stands out as a pioneering example of AI technology, particularly free access making door to enhance creative skills within the educational landscape.

Despite an eerie stance for ChatGPT capacities, Garcia (2023) echoes the growing interest surrounding ChatGPT's role in education. It is lauded for its ability to enhance students' learning by providing immediate feedback, responsiveness to student needs, and offering timely assistance to grasp challenging subjects. Consequently, ChatGPT has evolved into a valuable educational tool not a direct producer of creative content but more on the active repository of information, actively engaging students, offering continuous support in their quest for knowledge.

At the outset, much research has attempted to investigate the possible effects of AI at large, particularly in relation to education and the well-known ChatGPT tool for students (Garcia-Penalvo, 2023; Hwang & Chen, 2023). Numerous applications were examined, including chatbots, adaptive testing, tailored learning experiences, and predictive analytics. A number of studies have looked into the use of chatbots in education, highlighting their ability to improve learning experiences, provide tailored help, and improve services (Okonkwo, 2021; Peres et al., 2023). These researches identified and evaluated numerous forms of educational chatbots, including those that serve as service assistants or instructional agents (Smutny, 2020; Pérez, 2020). As a result, it may demonstrate perceived increase learning effectiveness and provide direct personalized educational support. It is discussed to take into account the risks and restrictions as well (Atlas, 2023; Ibrahim et al., 2023; El-Seoud et al., 2023; Lund & Wang, 2023).

2.6. Bridging Existing Micro-Level Theories: A Modicum

A theory espouses a crucial role in providing researchers with a comprehensive grasp of the underlying principles and serves as the foundational framework for any research endeavor across diverse fields of study. However, Rivard (2021) argues that the common idealized view of theory in research as a complete and flawless explanation of a phenomenon is unrealistic. Instead, he advocates for a more practical and iterative approach to theory building, emphasizing the pragmatic and evolving nature of theory construction in research.

As part of epistemological basis, micro-level frameworks in education indicate construct boundary among other broad scale theories which limit its parameter to the classroom and teaching learning processes (Bereiter, 2017). Borrowing from Bernstein's analytical framework, which emphasizes the presence of a curriculum and recognizing knowledge models, offers a valuable perspective for examining non-linear uncovering of educational technologies such as ChatGPT at the micro-level. Albeit this research enables how knowledge is conveyed and explored within educational interactions, it highlights the necessity of developing a timely micro-level theory in the field of EdTech, facilitating a more detailed analysis of how technology influences individual educational relationships and how teachers optimize instructions. Also, it sets the stage for a refined thought process and a robust belief in the research outcomes. This micro-level theory creation process is akin to paving grounded in sound principles and insights. To enrich this article prior to the theory building process, here are existing micro-level frameworks, not exhaustive list on EdTech:

Technological Pedagogical Content Knowledge (TPACK). The TPACK framework focuses on the intersection of the importance of educators efficiently incorporating technology into their instructional methods. While considering subject matter and pedagogical strategies, TPACK can help analyze how teachers' understanding of AI and educational technology influences their instructional decisions and student outcomes.

Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT framework explores elements impacting people's acceptance and utilization of technology. It recognizes crucial factors including anticipated performance, ease of use, and supportive conditions. Applying UTAUT can help understand teachers' attitudes, intentions, and behaviors regarding the adoption and use of AI-based educational technologies.

Community of Inquiry (CoI). The CoI framework focuses on the collaborative development of knowledge in online different contextual environments.

The T3 framework. In education, it refers to the Technology, Pedagogy, and Content Knowledge framework. It is a model that guides educators in integrating technology effectively into their teaching practices. The T3 framework emphasizes the interplay between technology, pedagogy, and content knowledge, highlighting the need for educators to have a balanced understanding and integration of these three components (Magana, 2020).

These frameworks offer theoretical lenses to investigate various aspects of educational technology in AI, including teacher knowledge and integration practices, technology acceptance and adoption, and online collaborative learning. But as a new horizon arises, new theory may be formed as the Education 4.0 is on the verge of AI, particularly with the pervasive use of ChatGPT in the teaching instruction.

3. Methodology

A grounded theory approach was employed in this research because the researchers systematically uncover the complexities and generate insights into the educational uses of ChatGPT, contributing to the field of educational technology and fostering evidence-based practices. Grounded theory has faced criticism for its perceived lack of quantitative elements in comparison to other research methodologies (Corbin & Strauss, 2008). However, critique overlooks the rigorous foundations of this approach, which position it not solely as qualitative research but as an inductive process. In the context of this study on educational technology using ChatGPT 3.0 or the latest models, grounded theory serves as a valuable approach for exploring and understanding the complex phenomena associated with the integration technologies.

This paper is motivated by the need for an emerging theory which prompted the researchers to follow Constructivist Grounded Theory (CGT) method, which allows to follow the data refinement and trace the events throughout the research process. This method emphasized the significance of social context, fostering a reciprocal relationship between researchers and participants, positioning researchers as active contributors to the data construction process ensuring a deep understanding of the studied phenomena patterned to several procedures (Chong & Yeo, 2015; Crotty, 1998; Karpouza & Emvalotis, 2019). To track the data in CGT, encoding and categorizing techniques were utilized. Employing

constant comparison techniques, the researchers meticulously collected and analyzed data. Memo-writing was utilized to construct coding, analyses, and theoretical sampling emerging theoretical concepts, thus, offering flexibility in data collection. Overall, the study design aligned with the constructivist notion that knowledge is constructed through interaction.

Initially, the data for this study were collected from thirty-four (34) teachers associated with four private high schools in Candelaria, Quezon, Philippines who have at least five years teaching experiences either in the Junior or Senior High School level and identified to utilize ChatGPT versions 3.0, 3.5 or with premium subscriptions, in some capacity. Since Grounded theory does not emphasize having a predefined sampling process (Cronholm, 2002; Amir & Beaudry, 2023), still the researchers exercised rigorous theoretical sensitivity to obtain saturation.

To gather insights from specific participants, a semi-structured interview format was utilized. For the interview protocol, a crafted interview guide through a thorough collaboration with an instrumentation specialist was made, aimed to extract perceptions regarding the utilization of ChatGPT. The interview questions were designed to be open-ended to gain more detailed and reflective answers. The "what is/can?", "so what?" and "so what now?" prompts were utilized since these probing questions helped the interviewee's thoughts and encourage them to elaborate on their responses.

Establish connections and reflection. The prompt "*What is/can…?*" encourage interviewees to think more critically about their responses and consider connections of ChatGPT about their professions.

Clarify and elaborate. The "*So, what?*" prompts were injected clarify vague or general statements. This is to provide specific examples or details to support participants' points.

Explore future actions or preflections. The "*So, what now?*" prompts can be particularly useful for exploring what actions or steps interviewees believe should be taken in light of their responses. This can be valuable for understanding potential solutions or constructing recommendations.

The instrument went through validation from two experts well-versed in education research, instrumentation, and qualitative grounded inquiry. In addition, using JAMOVI

software, *Fleiss' Kappa* was used in this process to assess the level of agreement among multiple expert validators when evaluating the interview protocol. *Fleiss Kappa* is a statistical measure used to quantify inter-rater or inter-observer agreement when multiple raters or judges are involved in evaluating an interview protocol in this case. For this study, the *Fleiss Kappa* value is 0.715 indicated substantial agreement among the expert validators.

Each interview had a duration of approximately 30 to 40 minutes. To ensure accuracy and thorough analysis, the interviews were recorded using audio recording equipment and subsequently transcribed. In accordance with research ethics, the researchers provide detailed information about the study's objectives, procedures, and potential risks prior to the interview, and the voluntary and informed consent of participants be obtained. Confidentiality is strictly maintained, and participants are assured that they have the right to withdraw from the study at any point without facing any adverse consequences.

Table 1

Coding phases of CGT

Coding Phase	Focus	Steps
Encoding	Input of data	1. Retrieving, importing, and scanning of data. 2. Removing unnecessary elements (e.g., filler words, false starts, personally identifiable information)
Initial	Identify the expressions and experiences from the verbatim texts	1. Examine the data line by line to understand the actions or events described. 2. Generate codes by capturing the participants' responses and expressions as they appear in the data. 3. Generate process codes by describing "what's taking place?" in the data.
Focused	Identify the initial codes that appear frequently and then employing clustering before analyzing data in detail.	1. Identifying the meaningful or commonly occurring codes within the data. 2. Apply these focused codes comprehensively across the entire dataset and use them as organizing categories for grouping related data segments. 3. Analyze through appraising the data within each group associated with the focused codes. 4. Further refinement of the focused codes into initial concept that encapsulate the common themes or concept as emerging from the data. 5. Develop the properties and characteristics of each category, continuing the process until the data reaches a state of saturation, indicating that no new significant insights are emerging.

Figure 1

Visualization process of CGT
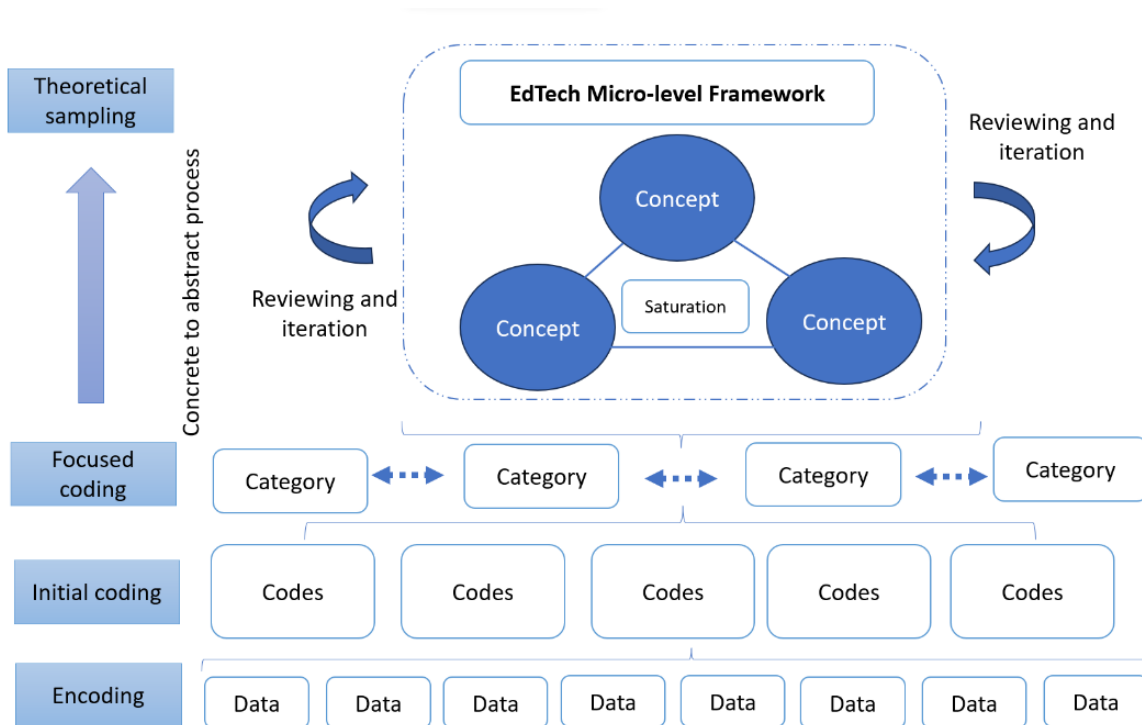
The coding process found in figure 1 was anchored to the Charmaz and Keller (2016) non-linear cohesive model. The study maintained an open-minded approach, remaining receptive to exploring various theoretical directions while there is a continuous refinement on the process since the coding system remains open and is not preconceived. As a result, the development of codes was achieved with the aid of QDA Miner lite application. This collaborative process results in an interpretive representation of reality within the research framework.

To support iterative and comparative analysis, subsequent round of interviews was delivered with a subset of ten informants selected from the initial participant pool. This simultaneous use of interviews and observations served to reinforce theoretical sampling that took one month to accomplish. The purpose of theoretical sampling is to gather sufficient and comprehensive data to establish theory(es) that pertain to the phenomena being investigated (Thornberg & Charmaz, 2014).

4. Findings and Discussions

Based on existing converging iteration with the participants, this section presents salient findings and emerging themes that arise from a CGT analysis of high school teachers' perspectives on ChatGPT. This study provides a suggested model from the findings.

Figure 2

Proposed model of micro-level framework
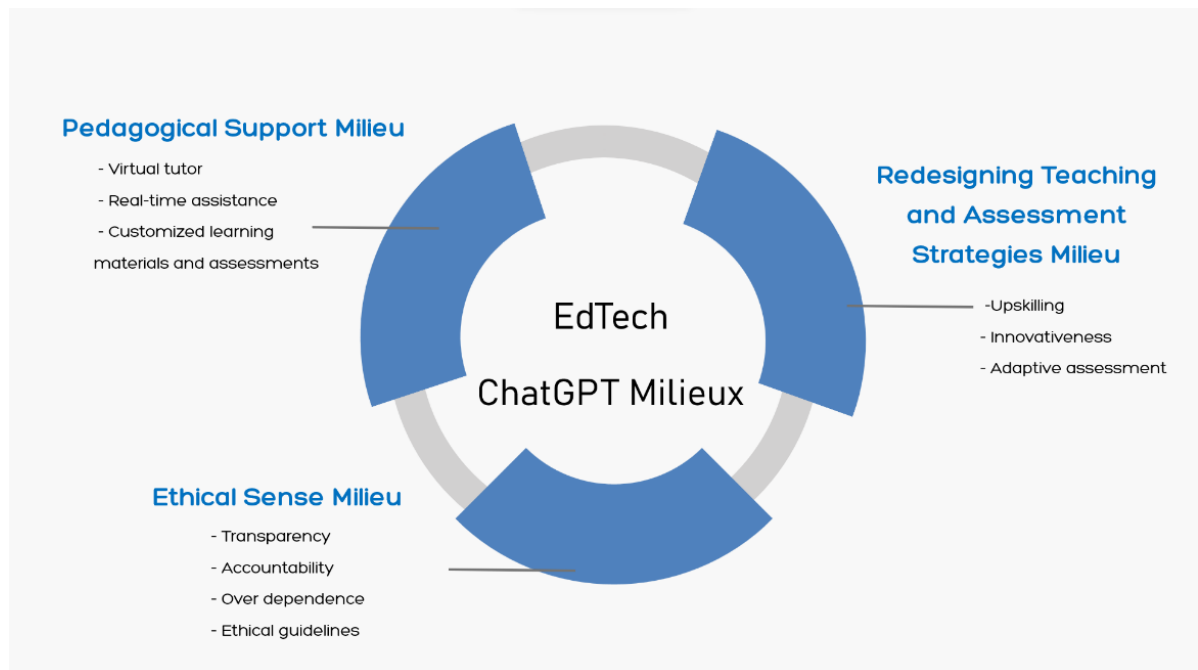
At the micro-level, a framework in educational technology refers to a specialized approach or model employed to comprehensively analyze and comprehend the utilization of technology within the educational sphere between how teachers confront ChatGPT onto the learning process. Unlike broader institutional or systemic perspectives, the framework is a non-sequential and non-linear paradigm which points general learning environment, such as a classroom, technological exposure, processes, and outcomes that transpire among learners, high school teachers, and other stakeholders. In granular level of examination, the micro-level framework, when taken together, provides insightful and in-depth understanding of how technology is effectively employed within educational contexts, enabling informed decision-making and impactful implementations as conceptualized by the secondary private school teachers.

The teachers have seen AI technologies from broad context, such as ChatGPT, offering unique opportunities for adaptive learning. They can provide tailored support, guidance, and immediate feedback to students' outputs, allowing for a more individualized approach to education. Through the analysis of user interactions, AI systems can understand learners' needs, preferences, and progress, and adjust their responses and recommendations accordingly. But from the coded responses in the context of educational technology, three milieux have emerged:

Pedagogical support milieu. Due to tumultuous workloads of teachers, ChatGPT act as a virtual guide, providing real-time assistance and explanations. It can answer questions, clarify concepts, and offer step-by-step guidance to support student learning. ChatGPT is seen to adapt its responses and resources to match the learning styles like offering customized exercises and learning materials based on the learners' needs. Primarily, teachers are using the technology for creating formative quizzes and grammar checking of materials. Thus, making feel teachers efficient in their works.

Redesigning teaching and assessment strategies milieu. This allows teachers to adapt their pedagogical approaches to individual student needs. Assessment techniques have been adaptive, with a departure from traditional standardized methods in favor of innovative, AI-enhanced assessments that focus on evaluating students' critical thinking and problem-solving skills. Also, continuous professional development has become essential, ensuring educators remain proficient in utilizing technologies.

Concern on ethical sense milieu. This sense comes to the looking glass self-process referring to the ethical considerations and concerns that arise with the use of AI in educational technology. These ethical implications encompass plagiarism, transparency, accountability.

4.1. Pedagogical support milieu

The theme of "pedagogical support milieu" emerged from the constant initial prompt of "*What is/can…?*" as a significant aspect in this paper. In the context of education technology and ChatGPT, this theme can be related to the role of educational technology in

providing pedagogical support within the learning environment. Through memo-sorting, here are some selected responses of the participants,

> *As a teacher, sobrang laking tulong ng ChatGPT. Para siyang kaibigan na laging handang tumulong. Sumasagot ito sa mga tanong, naglilinaw ng mga komplikadong problem, at nagpapaliwanag ng mga simpleng proseso. Parang kaibigan na kilala ka nang mabuti […] may personal na tutor sa math na kasama mo.* [As a teacher, ChatGPT is a huge help. It's like a friend always ready to assist. It answers questions, clarifies complicated problems, and explains simple processes. It is like a friend who knows you well [...] like having a personal math tutor with you.] *(Participant 04)*

> *Mabilis mag-simplify ng learning materials, lalo kapag ayos ang prompts.* [It quickly simplifies learning materials, especially when the prompts are clear.] *(Participant 13)*

> *Nakakatipid sa oras na puwede pa i-allot sa ibang productive tasks. Basta may internet connections.* [It saves time that can be allocated to other productive tasks, as long as there is an internet connection.] *(Participant 06)*

> *Hindi hassle ang paggawa ng learning materials lalo sa part ng assessment.* [Creating learning materials, especially in the assessment part, is not a hassle.] *(Participant 17)*

The transcribed interviews with teachers reveal the significant benefits of ChatGPT in instructional process, especially in simplifying and expediting the creation of learning materials, assessments, and providing personalized support to students. This aligns with the study's findings, demonstrating that ChatGPT serves as an efficient and effective tool for educators, allowing them to save time and resources while enhancing the learning experience through personalized assistance and resource generation.

ChatGPT, as an educational technology tool, can contribute to the pedagogical support milieu by offering various forms of assistance to students and educators. It can serve as a virtual tutor or mentor, providing personalized guidance and feedback to students. Through interactive conversations, ChatGPT can help clarify concepts, answer questions, and assist with problem-solving. This pedagogical support can be particularly beneficial in scenarios where individualized attention may be limited.

Furthermore, ChatGPT is perceived to guide the facilitations of educational resources and materials through selective suggestions. It can recommend an itemized learning material, provide explanations, and offer supplemental resources to supplement classroom instruction. This enhances the pedagogical support among teachers (Baidoo-Anu, 2023). Another, noteworthy category of ChatGPT is that it can foster collaborative learning environments by facilitating communication and discussion among students (Atlas, 2023). It is believed that it can be utilized as a platform for group interactions, allowing students to share ideas, engage in debates, and collaborate on projects. This social aspect of the pedagogical support milieu promotes active learning and knowledge construction.

Whilst ChatGPT can provide pedagogical support, its role reinstated to be complementary to human teachers. The generated responses do not provide cultural sensitivity and real-life applications but a generalized tone of suggestions. Wherefore, the presence of teachers is crucial to guide and contextualize the use of educational technology effectively. The pedagogical support milieu targets balance between the benefits of technology and maintaining the essential human element in education. Within the context of education, the "pedagogical support milieu" theme in the grounded theory framework highlights ChatGPT in facilitating access to resources, and collaborative learning environments.

4.2. Redesigning teaching and assessment strategies milieu

From the first theme, after participants contemplated their initial statements, this brought to uncover the second theme focused on the "*So what…*" prompt. Prior to this, three categories generated from the initial and focused coding are:

Adaptive teaching approaches. Teachers have embraced adaptive teaching approaches with the integration of ChatGPT. They have redesigned their instructional methods to align with the capabilities of AI, enabling personalized support and tailored content delivery. This adaptability has proven effective in addressing diverse learning needs among their students.

Dynamic assessment methods. The introduction of ChatGPT has prompted a shift in assessment paradigms. Teachers have moved away from traditional, uniform assessment methods and transitioned to more dynamic and personalized evaluation techniques.

Upskilling. Teachers have proactively engaged in upskilling, directly and indirectly, acquiring new skills and strategies to enhance their teaching as they acknowledge the value of different emerging EdTech.

Some testaments obtained are:

> *[…] to get authentic answers, teaching strategies ay dapat ding i-improve para makasabay tayo sa competencies.* [to obtain authentic answers, teaching strategies should also be improved to keep up with competencies.] *(Participant 19)*

> *Challenge ang pag-deliver ng lessons, kaya differentiated ang atake sa pagtuturo at hindi puro "the know lang" ang mga tanong kailangan may critical thinking kasi ang facts given at established sa online.* [Delivering lessons poses a challenge, so the teaching approach needs to be differentiated, and the questions should not solely focus on "the known." Critical thinking is essential because the facts provided are established online. *(Participant 27)*

The responses from the participants accentuate the teaching and assessment strategies as they grapple with the challenge of delivering authentic and engaging lessons; it becomes evident that a shift away from rote memorization towards more critical thinking and competency-based approaches is essential. This resonates with current educational research, emphasizing the need for pedagogical strategies that foster higher-order thinking skills, as outlined by Revised Bloom's taxonomy. The shift toward competencies and critical thinking aligns with the broader academic discourse on active learning and student-centered approaches, where the focus is on knowledge application and problem-solving rather than mere retention of facts (Elsayed, 2023; El-Seoud et al., 2023; Rudolph et al., 2023). It is clear that in the redesigning of teaching and assessment strategies, educators are moving toward a more dynamic and engaging milieu, confronting the demands of the digital age.

> *Need ayusin ang paggawa ng quiz at kung paano i-a-assess nang maayos ang learning outputs ng mga bata.* [There is a need to organize the creation of quizzes and establish a proper method for assessing the learning outputs of the children.] *(Participant 01)*

> *Kapag tama ang prompts or tanong, maganda rin sagot niya [ChatGPT], kaso general ang sagot lagi, kaya mahahalata na galing sa AI.* [When the prompts or questions are precise, ChatGPT provides excellent answers. However, its responses tend to be general, revealing that they come from an AI.] *(Participant 11)*

As supported by Baidoo-Anu and Ansah (2023), the revamp of academic instructions addressing the substantial concerns related to AI, approach to ChatGPT and its future iterations, should promote open and interdisciplinary discussions as paralleled to the participants' view, albeit ChatGPT is a valuable tool, it lacks the deep understanding and context that teachers provide. Still teachers play a critical role in adapting AI-generated content to suit the specific needs and curriculum of their students, reinforcing the importance of their expertise in delivering effective and meaningful deliverables of instructions (Duha, 2023; Elsayed, 2023). Moreover, ChatGPT not only compels review outdated teaching methods but also compels to break out traditional individualized domains and collaborate with colleagues from diverse fields and disciplines. Thus, making informed decisions for learners.

4.3. Ethical sense milieu

The theme "ethical sense milieu" is an overarching concerns arising from the prompt "*So, what now?; Quo Vadis* (Where will it lead us?)" in the context of using ChatGPT. This milieu resulted from the sense of doubt of teachers regarding the harnessing of AI. This theme encompasses several key ethical aspects, including plagiarism, transparency, accountability of teachers *per se* and its implicit impact on their students. As stated by the participants,

> *ChatGPT is here to stay na… it has become an essential support, 'yun nga lang tingin ko ay hindi gaanon [sic] makakatulong ito para lalong mag-isip at maging creative ang tao.* [ChatGPT is here to stay; it has become an essential support. However, I think it may not contribute significantly to stimulating deeper thinking and enhancing human creativity.] *(Participant 05).*

> *It [ChatGPT] will serve a good avenue for creating instructional plans, but needs to revisit at i-counter check lahat ng information generated ng ganitong tool…* It [ChatGPT] will serve as a good avenue for creating instructional plans but needs to be revisited and cross-checked for all information generated by this tool.] *(Participant 07)*

While ChatGPT can assist in content creation, it may not always produce high-quality educational materials. If teachers do not critically evaluate and edit the AI-generated content, it may contain inaccuracies or biases, negatively impacting the learning experience. Another argued,

No one can deny naman that it [ChatGPT] helps but in short-term case. Tampulan ito ng plagiarism at mag-evoke ng katamaran sa mga bata. [No one can deny that it (ChatGPT) helps, but only in the short term. It can be a source of plagiarism and may evoke a sense of laziness in children.] *(Participant 14)*

ChatGPT offers several advantages, like development of learning assessments, improvements in pedagogical techniques, but there is [a] main concern […] first and foremost is that anyone can use it. Malaking problema ang assessment bilang factor […] also the quality of content ng bata ay puwedeng doubtful. [ChatGPT offers several advantages, such as the development of learning assessments and improvements in pedagogical techniques. However, a main concern is that anyone can use it. Assessment is a significant problem as a factor, and the quality of a child's content may be doubtful.] *(Participant 23)*

In a short-term context, ChatGPT can be beneficial but has the potential to encourage plagiarism and student apathy. While it offers advantages like enhancing learning assessments and pedagogical techniques, a significant concern is its widespread accessibility, leading to challenges in assessment reliability and potential doubts regarding the quality of student-generated content. Another paper contends that while ChatGPT as a fait accompli, one can provide the provision of virtual personalized tutoring, assistance in generating outlines, and facilitating idea generation, highlighting potential concerns tied to academic integrity, the potential for unfair learning assessments, the accuracy of information (Memarian & Doleck, 2023; Sok & Heng, 2023).

Furthermore, the looking glass self for this milieu is a feedback loop, which means that teachers' perceptions of themselves and their role can affect their behavior. It is observed that teachers perceive themselves as innovative and technology-forward, they may be more likely to continue exploring and adopting new educational technologies, including ChatGPT. Teachers' perception of themselves as educators are opined to balance technology and human interaction which can influence their ethical considerations. Despite speculations that ChatGPT will be abused by students and over dependence of teachers for support still they are more inclined to ensure that AI tools like ChatGPT are used to enhance, not replace, human engagement in the learning process. Concomitantly, one of the primary ethical concerns is over reliance. Also, schools and educators must adhere to data privacy regulations and implement appropriate measures to safeguard student information from unauthorized access or misuse (Qasem, 2023).

Transparency and accountability are crucial ethical dimensions when using ChatGPT in education (Mhlanga, 2023; Reiss, 2021; Srinivasa et al., 2022; Tiwari et al., 2023). Since not all teachers are well-versed with the AI language, it is opined to initiate school discussions about any ethical issues. Hence, the central category for this lies on the ethical consideration primarily plagiarism which catapults for institutional ethical guidelines. Even Noam Chomsky, a luminary of modern linguistics, expressed his predicament statement that AI is *"high-tech plagiarism"* prompting everyone to address the potential misuse of these tools for plagiarism.

5. Conclusion

ChatGPT is a relevant and on par supplement for EdTech and navigating the implications associated with AI in education as it continuously penetrates educational landscapes is crucial. In an argumentative sense, private school teachers are believed to be proactive in using ChatGPT particularly in preparing for instructional materials without compromising responsible and ethical sense. This sense ensures that the integration of AI in education upholds ethical standards, respects data privacy, discourages plagiarism, promotes transparency and accountability, and strives for equitable access to AI tools through responsive adapting to challenges posed by advancement in technology. This study also advances the argument that ChatGPT holds immense promise in transforming the field of education and reshaping how students must be taught. But not all are breath of fresh air, by counting AI, the fear inquiries are on the rise, too. In particular, the utilization of ChatGPT is an AI ubiquity for enhancing the overall learning experience and preparing instructional materials of teachers – balancing the students' needs. It also identifies and seek policy formulations for schools discussing implications vis-à-vis ethical use of AI in education while maintaining the fruits being seek from the large language models.

6. Limitations

This study has acknowledged its limitations. Firstly, it exclusively employs an interpretative approach for theory building, prioritizing textual analysis over quantitative data. Secondly, it relies on textual context and personal experiences and proceeded refinement phases due to the nature of research design, making comparisons and generalizations less applicable. Finally, the participant pool is relatively small, which may

limit the broader applicability and replicability of findings. Nevertheless, these limitations do not diminish the value of the research, as it adheres to a well-established Standards for Reporting Qualitative Research (SRQR), and rigorous methodology.

7. Reflexivity

The authors' journey in developing the micro-level framework for EdTech mirrors the iterative process described. Early on, the authors engage in constant reading, reflecting, and writing activities that evolve with the research phases. At the outset, introspection about the motivation for EdTech framework development take precedence. The process then advances to reading literatures, reflecting, and rereading, with the aim of identifying trends, gaps, or challenging assumptions within the EdTech domain. As the research deepens, reflection blends with practical experimentation and dry runs, enriching the framework with hands-on insights. Throughout, writing remains intermittent, capturing the evolving EdTech micro-level framework, from jotting down initial ideas to documenting findings, modeling the framework, and verbalizing the emerging theory. This reflexivity declares the evolving nature of the authors' thought process yielding EdTech micro-level framework.

8. Conflict of interest

The authors assert that this qualitative study was carried out due to research enthusiasm, without any financial interests and organizational attachments that might be seen as a possible source of conflicts of interest.

References

Amir T. & Beaudry C. (2023) An emergent grounded theory of AI-driven digital transformation: Canadian SMEs' perspectives. *Industry and Innovation*, 30:9, 1244-1273, DOI: 10.1080/13662716.2023.2242285

Andriole, S. J. (2020). Innovation, emerging technology, and digital transformation. *IT Professional* 22 (4): 69–72, 1. https://doi.org/10.1109/MITP.2020.2985491

Atlas, S. (2023). *ChatGPT for higher education and professional development: A guide to conversational AI*. The University of Rhode Island.

https://digitalcommons.uri.edu/cgi/viewcontent.cgi?article=1547&context=cba_facpubs

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, *7*(1), 52-62.

Bereiter, C. (2017). Theory Building and Education for Understanding. In: Peters, M.A. (eds) *Encyclopedia of Educational Philosophy and Theory*. Springer, Singapore. https://doi.org/10.1007/978-981-287-588-4_370

Bernstein, B. (2000). *Pedagogy, symbolic control and identity: Theory, research, critique* (Rev. ed.). Lanham: Rowman & Littlefield Publishers, Inc.

Cain, C.C., Buskey, C.D. and Washington, G.J. (2023). Artificial intelligence and conversational agent evolution – a cautionary tale of the benefits and pitfalls of advanced technology in education, academic research, and practice. *Journal of Information, Communication and Ethics in Society*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JICES-02-2023-0019

Charmaz K., & Keller R. (2016). A personal journey with grounded theory methodology. *Forum Qual Soc Res*.17(1): https://doi.org/10.17169/fqs-17.1.2541

Chong, C., & Yeo, K. (2015). An overview of grounded theory design in educational research. *Asian Social Science*, *11*(12), 258–268. https://doi.org/10.5539/ass.v11n12p258

Cronholm, S., & Remenyi, D. (2002). Grounded theory in use: A review of experiences. Proceedings of the First European Conference on Research Methodology for Business and Management Studies (ECRM 2002. Presented at the *First European Conference on Research Methodology for Business and Management Studies* (ECRM 2002) (Remenyi D, ed), Reading, UK, Apr 29-30, 2002.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research (3rd ed.): Techniques and procedures for developing grounded theory*. SAGE Publications, Inc., https://doi.org/10.4135/9781452230153

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. SAGE Publications.

Duha, M. S. U. (2023). ChatGPT in education: An opportunity or a challenge for the future? *TechTrends*. https://doi.org/10.1007/s11528-023-00844-y

Elsayed, S. (2023). Towards mitigating ChatGPT's negative impact on education: Optimizing question design through bloom's taxonomy. In *2023 IEEE region 10 symposium (TENSYMP)* (pp. 1–6). https://doi.org/10.1109/TENSYMP55890.2023.10223662

El-Seoud, S., Shehab Eldeen, A., Khaled, N., & Karam, O. H. (2023, August 6). The impact of ChatGPT on student learning/performing. *SSRN*. http://dx.doi.org/10.2139/ssrn.4532913.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education*, 59, 423-435. https://doi.org/10.1016/j.compedu.2012.02.001

Estrellado, C. J. P., & Miranda, J. C. (2023). Artificial intelligence in the Philippine educational context: Circumspection and future inquiries. *International Journal of Scientific and Research Publications*, *13*(5), 16. https://doi.org/10.29322/IJSRP.13.04.2023.p13704

Garcia-Penalvo, F. J. (2023). The perception of artificial intelligence in educational contexts after the launch of ChatGPT: Disruption or panic? *Education in Knowledge Society*, 24. https://doi.org/10.14201/eks.31279

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory. Strategies for qualitative research*. Transaction Publishers.

Greitemeyer, T., & Kastenmüller, A. (2023). HEXACO, the Dark Triad, and Chat GPT: Who is willing to commit academic cheating? *Heliyon*, 9(9). https://doi.org/10.1016/j.heliyon.2023.e19909

Hallberg, L. (2006). The "core category" of grounded theory: Making constant comparisons. *International Journal of Qualitative Studies on Health and Well-Being*, *1*(3), 141–148. https://doi.org/10.1080/17482620600858399

Haluza, D. & Jungwirth, D. (2023). Artificial intelligence and ten societal megatrends: An exploratory study using GPT-3. *Systems,* 11, 120.

Hofer, M., & Grandgenett, N. (2012). TPACK development in teacher education: A longitudinal study of preservice teachers in a secondary M.A.Ed. program. *Journal of Research on Technology in Education*, 45, 83–106.

Hwang, G.-J., & Chen, N.-S. (2023). Editorial position paper: Exploring the potential of generative artificial intelligence in education: Applications, challenges, and future research directions. *Educational Technology & Society*, *26*(2). https://www.jstor.org/stable/48720991

Ibrahim, H., Asim, R., Zaffar, F., Rahwan, T., & Zaki, Y. (2023). Rethinking homework in the age of artificial intelligence. *IEEE Intelligent Systems*, 38(2), 24-27. https://doi.org/10.1109/MIS.2023.3255599

Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *Bench Council Transactions on Benchmarks, Standards and Evaluations*, 3(2), 100115. https://doi.org/10.1016/j.tbench.2023.100115

Karpouza, E., & Emvalotis, A. (2019). Exploring the teacher-student relationship in graduate education: A constructivist grounded theory. *Teaching in Higher Education*, *24*(2), 121–140. https://doi.org/10.1080/13562517.2018.1468319

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, 13(4), 410. http://dx.doi.org/10.3390/educsci13040410

Lund, B.D. & Wang, T. (2023). Chatting about ChatGPT: How may AI and GPT impact academia and libraries? *Library Hi Tech News*, 40(3), 26-29. https://doi.org/10.1108/LHTN-01-2023-0009

Magana, S. (2020). Disruptive classroom technologies. https://doi.org/10.1093/acrefore/9780190264093.013.423

Memarian, B., & Doleck, T. (2023). ChatGPT in education: Methods, potentials, and limitations. *Computers in Human Behavior: Artificial Humans*, 1(2), 100022. https://doi.org/10.1016/j.chbah.2023.100022.

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. In: *FinTech and Artificial Intelligence for Sustainable Development. Sustainable Development Goals Series*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-37776-1_17

Mirrlees, T. & Alvi, S. (2019). *EdTech Inc.: Selling, Automating and Globalizing Higher Education in the Digital Age* (1st ed.). Routledge. https://doi.org/10.4324/9780429343940

Montenegro-Rueda, M., Fernández-Cerero, J., Fernández-Batanero, J. M., & López-Meneses, E. (2023). Impact of the implementation of ChatGPT in education: A systematic review. *Computers*, *12*(8), 153. MDPI AG. Retrieved from http://dx.doi.org/10.3390/computers12080153

Neumann, M., Rauschenberger, M., & Sch¨on, E.-M. (2023). We need to talk about ChatGPT: The future of AI and higher education. In 2023 *IEEE/ACM 5th international workshop on software engineering education for the next generation* (SEENG) (pp. 29–32). https://doi.org/10.1109/SEENG59157.2023.00010

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.

Okonkwo, W.C., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Comput. Educ. Artif. Intell*., 2, 100033.

OpenAI. (2022). ChatGPT. https://openai.com/blog/chatgpt [accessed 2023-05-28]

Peres, R., Schreier, M., Schweidel, D., & Sorescu, A. (2023). On ChatGPT and beyond: How generative artificial intelligence may affect research, teaching, and practice. *International Journal of Research in Marketing*. https://doi.org/10.1016/j.ijresmar.2023.03.001

Pérez, J.Q., Daradoumis, T., & Puig, J.M. (2020). Rediscovering the use of chatbots in education: A systematic literature review. *Computer Applications in Engineering Education*, 28, 1549 - 1565.

Qasem, F. (2023). ChatGPT in scientific and academic research: future fears and reassurances. *Library Hi Tech News*, 40(3), 30-32. https://doi.org/10.1108/LHTN-03-2023-0043

Rahman MM, Watanobe Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences*; 13(9):5783. https://doi.org/10.3390/app13095783

Reiss, M. J. (2021). The use of AI in education: Practicalities and ethical considerations. *London Review of Education*, *19*(1), 5, 1–14. https://doi.org/10.14324/LRE.19.1.05

Rivard, S. (2021). Theory building is neither an art nor a science. It is a craft. *Journal of Information Technology*, 36(3), 316-328. https://doi.org/10.1177/0268396220911938

Rudolph, J., Tan, S., & Tan, S. (2023) ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning and Teaching*, 6(1).

Rummel, N., Walker, E., & Aleven, V. (2016). Different futures of adaptive collaborative learning support. *International Journal of Artificial Intelligence in Education*, 26, 784–795. https://doi.org/10.1007/s40593-016-0102-3

Seaba, V.E.S. (2023) Revolutionizing education: Exploring the potential of AI-enabled brain-based learning for enhanced cognitive development. *Open Access Library Journal*, 10, 1-20. doi: 10.4236/oalib.1110763

Selwyn, N. (2012). Education in a digital world: Global perspectives on technology and education. *Routledge*. https://doi.org/10.4324/9780203108178

Simone Grassini, (2023). Shaping the future of education: Exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*. 2023; 13(7):692. https://doi.org/10.3390/educsci13070692

Sok, S., & Heng, K. (2023, March 6). ChatGPT for education and research: A review of benefits and risks. *SSRN*. https://ssrn.com/abstract=4378735

Srinivasa, K. G., Kurni, M., & Saritha, K. (2022). Harnessing the power of AI to education. In *Learning, Teaching, and Assessment Methods for Contemporary Learners* (pp. 311-342). Springer, Singapore.

Thornberg, K., & Charmaz, K. (2014). Grounded theory and theoretical coding. In U. Flick (Ed.), *The SAGE handbook of qualitative data analysis* (pp. 153–169). SAGE Publications Inc. https://dx.doi.org/10.4135/9781446282243.n11

Tiwari, C.K., Bhat, M.A., Khan, S.T., Subramaniam, R. and Khan, M.A.I. (2023). What drives students toward ChatGPT? An investigation of the factors influencing adoption and usage of ChatGPT. *Interactive Technology and Smart Education*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/ITSE-04-2023-0061

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N. & Polosukhin, I. (2017). Attention is all you need. *Advances in neural information processing systems*, 30, 5998-6008.

Zhai Xi, (2023). ChatGPT and AI: The game changer for education. *SSRN*. https://ssrn.com/abstract=4389098

Zhai, X., & Pellegrino, J. (2023). Large-scale assessment in science education. In N. G. Lederman, D. L. Zeidler, & J. S. Lederman (Eds.), *Handbook of research on science education,* 3, 1045-1098).