Exploring the Lived Experiences of Teachers Implementing or Preparing to Implement Artificial Intelligence at K-12 Schools in the United States: A Qualitative Phenomenological Study

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Abstract

Innovations in educational technology have resulted in a proliferation of applications powered by artificial intelligence (AI). The problem was K–12 teachers lacked sufficient experience and professional development opportunities to implement artificial intelligence in classroom environments effectively in the United States. The purpose of this qualitative phenomenological study was to explore K–12 teachers' lived experiences related to implementing or preparing to implement artificial intelligence and the professional development needed for implementation. A gap in the literature exists regarding the impact of AI implementation in K–12 learning environments on Generation Alpha and related teacher professional development. Research questions were studied through the alignment of stages of concern from the concerns-based adoption model and the lens of constructivism. Teachers' lived experiences with implementing or preparing to implement AI in K–12 learning environments and professional development opportunities were explored. Fifteen teachers working in the United States were recruited through a private social media group and postings. After completing an online questionnaire, participants responded to open-ended questions through a Google Form or during interviews. Data were transcribed and coded using a data analysis spiral approach. Resulting themes were analyzed to determine connections among participants' lived experiences. Findings revealed that participants used AI-powered tools to save time on tasks. Participants experienced increased student engagement when AI was incorporated into learning environments. Professional development was limited and often self-initiated. Recommendations included districts investing in professional development and resources that promote responsible AI implementation. Reviewing and modifying policies to address AI were also recommended.

Keywords: artificial intelligence, ChatGPT, concerns-based adoption model, constructivism, Education 4.0, ethics, Generation Alpha, professional development

Dedication

I dedicate this dissertation to my father and mother, sister, aunts, uncles, cousins, extended family, friends, and all individuals near and far who supported me in this journey.

Acknowledgments

All glory to God for guiding me through this dissertation journey during a difficult time. To my family for supporting and encouraging me each step of the way. I am appreciative that Dr. Barry Chametzky challenged me to be my best self and never gave up on me. Thank you, Dr. Richard Herring, for being part of the dissertation committee. Your guidance was invaluable. I would also like to express gratitude to Dr. Wes Anthony because I do not know where I would be in the dissertation process had he not reached out to me during a challenging moment. To everyone who kept me uplifted and focused, words can never truly express my gratitude.

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Chapter 1: Introduction

The 21st century heralded a transformation in education with regard to innovations in educational technology (Moreno-Guerrero et al., 2022). Emergence of the internet, combined with advances in computing, led to a proliferation of programs, platforms, and applications designed to connect students and teachers on levels unimagined in previous years (Yilmaz, 2021). Students also had various options to meet their educational needs, including online courses (Morgan, 2015). Learning was no longer limited to face-to-face classes and paper-based instruction (Morgan, 2015; Moreno-Guerrero et al., 2022).

The COVID-19 pandemic served as a catalyst for educational technology integration but also exposed shortcomings in access and necessary resources (Al-Rohaimi & Al Otaibi, 2020). Many applications designed for technology integration were driven by artificial intelligence (AI); however, teachers were unaware of AI or lacked sufficient knowledge of how AI worked within learning environments (Oster et al., 2021). Exploring the lived experiences of K–12 teachers who have used or are preparing to use AI in their learning environments, as well as their experiences with professional development related to AI, provided insight into the potential impact of AI in education. Potential benefits of the study included educational stakeholders having an increased awareness of artificial intelligence applications and advantages ranging from increased efficiency to personnel solutions. As more stakeholders gain knowledge about artificial intelligence applications, they will develop policies and frameworks leading to increased successful implementations in K–12 school districts in the United States (Huang et al., 2021).

Chapter one outlines the background of the problem, statement of the problem, purpose of the study, significance of the study, research questions, theoretical framework, definition of terms, assumptions, scope and delimitations, and limitations. The problem and purpose related to AI in education are delineated, and questions are posed to drive the study. A theoretical

framework of constructivism and the concerns-based adoption model (CBAM) are examined. Along with the aforementioned topics, explorations of assumptions and limitations related to AI in education and teachers' lived experiences provide a well-rounded overview to inform the basis for the study.

Background of the Problem

The roots of artificial intelligence in education can be traced to computer scientist Alan Turing, who devised the Turing Test (Turing, 1950), and a group of scientists who proposed a convening to explore artificial intelligence titled *The 1956 Dartmouth Summer Research Project on Artificial Intelligence* (McCarthy et al., 1955). In the late 1960s, the first applications of artificial intelligence in education, Intelligent Tutoring Systems (ITSs) and Intelligent Learning Environments (ILEs), were introduced in institutions of higher learning (du Boulay, 2019; Kulik & Fletcher, 2016). Expanded applications of AI emerged in the early 21st century (Almeida & Simoes, 2019).

COVID-19 and the resulting global pandemic forced educational institutions at all levels to provide instruction online (Oster et al., 2021). Despite years of educational technology integration, many teachers struggled with transitioning to virtual learning environments (Edelhauser & Lupu-Dima, 2021). There were also barriers that limited students' access to Wi-Fi, programs and hardware necessary for instruction (Oyeniran & Oyeniran, 2020).

After face-to-face learning returned, teachers still lacked the knowledge needed to navigate programs increasingly powered by artificial intelligence (Prahani et al., 2022). Winter et al. (2021) indicated that only 64% of teachers reported using technology on a regular basis, but the usage centered on administrative tasks and not instructional activities. In a study from the Institute of Education Sciences, just under two-thirds of teachers surveyed stated they lacked time to learn new technologies (Gray et al., 2021).

There is a gap in the literature related to technology integration and the impact of educational technology on Generation Alpha, students who were born during or after 2010 (Holmes et al., 2019; McCrindle & Fell, 2021). A study exploring teachers' experiences integrating educational technology powered by artificial intelligence added insight into how districts can adapt to meet Generation Alpha's needs. Decision-makers could also have a reference on how to provide professional development to teachers needing to further integrate educational technology into their classrooms.

Statement of the Problem

The problem was K–12 teachers lacked sufficient experience and professional development opportunities to implement artificial intelligence in classroom environments effectively in the United States (Kim & Kim, 2022). Artificial intelligence has potential benefits, including personalization of learning to meet the needs of all students and relieving teachers from completing repetitive or time-consuming tasks (Maghsudi et al., 2021; Popenici & Kerr, 2017). There are also challenges inherent in artificial intelligence due to the amounts of data needed to execute applications, which include, but are not limited to, bias, ethics, and privacy (Huang et al., 2021; Weinstein, 2020).

To meet the needs of a society increasingly reliant on technology, coined Industry 4.0, teachers and students must be equipped with the skills and knowledge necessary to navigate a rapidly changing landscape (John et al., 2021; Moloi & Mhlanga, 2021). There are more than 3 million K–12 teachers in the United States of America, and many are unaware of the impact AI has on their learning environments (National Center for Education Statistics, 2020; Weiwei, 2022). Research provided insights into the lived experiences of teachers who have used AI and serve as a basis for providing resources and professional development opportunities (Tanguihan, 2021).

Purpose of the Study

The purpose of the study was to explore K–12 teachers' lived experiences with implementing or preparing to implement artificial intelligence and the professional development needed for implementation. Understanding a real-world issue related to artificial intelligence in education was the goal of the study; therefore, qualitative research was best-suited to explore and describe the topic (Dubovicki & Topolovčan, 2020). A phenomenological design was used because the study focused on the lived experiences of teachers who implemented or prepared to implement artificial intelligence.

Exploring lived experiences of K–12 teachers to provide guidance to educational stakeholders who may implement artificial intelligence was the rationale for the study. A questionnaire was used to collect data from 15 K–12 teachers. Qualified participants worked in schools located in the United States of America. Although face-to-face interviews are a traditional method for collecting qualitative data, non-synchronous methods are also recognized for data collection (Braun et al., 2020; Jones et al., 2021). Therefore, teachers responded to open-ended questions online or completed semi-structured interviews via video conferencing.

Significance of the Study

Findings of the qualitative phenomenological study can expand the knowledge related to the phenomena of K–12 teachers implementing or preparing to implement artificial intelligence in learning environments and related professional development. Providing information regarding the phenomena can help teachers, administrators, and policymakers prepare to implement artificial intelligence applications in K–12 school districts in the United States. Kim and Kim (2022) and Weiwei (2022) identified teachers' lack of knowledge and experience regarding artificial intelligence applications in K–12 learning environments, indicating there is minimal

information available about the lived experiences of K–12 teachers who have implemented or plan to implement artificial intelligence applications.

Results from the study can also guide professional development planners because of the insights from K–12 teachers' lived experiences with professional development related to artificial intelligence applications. Professional development is essential for building capacity, particularly when implementing new initiatives such as artificial intelligence applications (Thoma et al., 2017). Instead of suspicions stemming from stories of AI-powered robots replacing teachers, solutions highlighting how AI can help teachers complete time-consuming tasks were revealed (Barakina et al., 2021; Marrhich et al., 2021; Popenici & Kerr, 2017). Community concerns about the loss of privacy and ethical mishaps could be assuaged with the development of policy changes related to artificial intelligence applications at the local district, state, or national level (Huang et al., 2021; Morley et al., 2020).

Research Questions

Research questions promote the exploration of the lived experiences of teachers implementing artificial intelligence in K–12 classrooms or participating in professional development in the United States (Tanguihan, 2021). Exploring lived experiences will serve as a guide for teachers who lack sufficient experience with artificial intelligence applications (Kim & Kim, 2022; Weiwei, 2022). These questions guided this study:

Research Question 1: What are teachers' lived experiences with implementing artificial intelligence applications in K–12 learning environments in the United States?

Research Question 2: What are teachers' lived experiences with professional development opportunities related to implementing artificial intelligence applications in K–12 learning environments in the United States?

Theoretical Framework

Constructivism underlay the research of this qualitative phenomenological study exploring the lived experiences of K–12 teachers related to artificial intelligence. Rooted in the work of Jean Piaget, constructivism theory is a framework that can provide insights into how individuals learn (Hanfstingl et al., 2019; Piaget, 1994). Through constructivism, students gain knowledge when they can actively participate in the learning process (Piaget, 1994). There are several variations of constructivism, including cognitive constructivism and social constructivism (Finnegan & Ginty, 2019; Zhang & Lin, 2018). Cognitive constructivism focuses on learning as students construct knowledge through active participation and prior experience (Zhang & Lin, 2018). Social constructivism, which Lev Vygotsky developed, incorporates interactions between individuals in the learning environment as part of acquiring new knowledge (Finnegan & Ginty, 2019).

Implementing artificial intelligence applications requires change and the concerns-based adoption model (CBAM) measures the processes of implementing change (Trapani & Annunziato, 2018). CBAM is a framework providing researchers the ability to predict, measure, and explain what educators experience when implementing education-focused innovation (Al Masarweh, 2019; George et al., 2013). The alignment of the implementation of technological innovation and the attitudes and beliefs of educators can be measured through a CBAM analysis, which includes the stages of concern (Olson et al., 2020). Applying constructivism and CBAM stages of concern to a phenomenological study connected lived experiences, learning processes, and the mechanizations of change (Min, 2017; Trapani & Annunziato, 2018). Further discussion of the theoretical framework is found in Chapter 2.

Definition of Terms

Readers may be unfamiliar with some of the terminology used in the study. Definitions can help facilitate understanding of terms as they relate in context to the study (Peoples, 2021). Therefore, key concepts are defined with paraphrasing derived from sources.

Artificial intelligence is a computerized system consisting of code that can mimic human intelligence (Pierce & Hathaway, 2018).

Augmented reality is defined as computer programs using digital images to simulate real-world environments accessible through multiple devices (Andone & Frydenberg, 2017).

ChatGPT is an artificial intelligence chatbot developed by OpenAI that uses natural language processing to generate text based on prompts (Siegle, 2023).

Deep learning is a subset of machine learning using neural networks to process and learn from primarily unstructured sets of data (Obembe & Obembe, 2020).

Education 4.0 is a term referencing a stage of the educational system characterized by student choice in learning and applications of educational technology powered by artificial intelligence (Almeida & Simoes, 2019; Moloi & Mhlanga, 2021).

Generation Alpha is comprised of individuals born during or after 2010 who are living in a society dominated by technological advances (McCrindle & Fell, 2021).

Generative Pre-trained Transformers (GPTs) are neural network models that use supervised and reinforcement techniques to model human communication (Bozkurt et al., 2023).

Industrial Age refers to the four stages of technological innovations beginning with the invention of the steam engine and ending with advancements in AI-powered robotics and automation (Caudill, 2020).

Intelligent learning environments are virtual, computer-based applications that can adapt based on students' actions while interacting with the applications (du Boulay, 2019).

Intelligent tutoring systems are computer-based applications that adapt instructional support based on learner input and need (du Boulay, 2019).

Machine learning is a subset of artificial intelligence where computers learn based on code, algorithms, and data (Pierce & Hathaway, 2018).

Natural language processing (NLP) is a series of techniques and programs grounded in computer science designed to promote human-machine interactions through communication (Chary et al., 2019).

Neural networks consist of layers of nodes computers use to train themselves based on input data sets (Muniasamy & Alasiry, 2020).

Personalized learning is an educational framework providing students with specific learning targets based on needs or interests and is determined through a series of assessments and survey instruments (Maghsudi et al., 2021).

Virtual reality is a series of immersive, real-world simulations accessible through specialized headsets (Enis, 2018).

Assumptions

Creswell and Poth (2018) defined assumptions in qualitative research as beliefs about a topic or subject that are present before research commences but can be set aside through bracketing or modified after reflection. Initially developed by Husserl, bracketing, also known as *epoche*, involves setting aside personal bias, judgment, and experiences to focus on perceiving the phenomenon being studied through a fresh lens (Husserl, 1931/2017; Moustakas, 1994). There are several assumptions related to this qualitative phenomenological study. First, Peoples (2021) noted that any potential bias should be bracketed by setting aside judgments when interacting with participants and data. Therefore, bracketing was used during the study to alleviate bias. Second, participants understood how to complete the questionnaire and respond to

the interview questions based on lived experiences specific to implementing or planning to implement artificial intelligence. Third, participants were familiar with artificial intelligence since exploring lived experiences presupposed prior interaction. Fourth, participants' demographic information, including gender and age ranges, and years of service and technology integration would add context and substance to lived experiences. Recognizing assumptions was necessary to promote neutrality throughout the research process (Coleman, 2021).

Scope and Delimitations

Delimitations refer to areas over which researchers have control and the boundaries set to maintain focus on research questions (Coker, 2022). A phenomenological study was a delimitation because the research design was chosen to focus on lived experiences (Moustakas, 1994; Peoples, 2021). In accordance with the research questions, only participants who were implementing or preparing to implement artificial intelligence and related professional development were included, and the data collected included lived experiences.

A social media group comprised of educators interested in artificial intelligence or implementing artificial intelligence in their learning environments was a delimitation because it was selected to gather a sample size of 15 teachers. After providing informed consent, each participant was asked to complete two instruments, a questionnaire and a semi-structured interview, which were delimitations because they were selected to elicit context and detailed descriptions.

The study was bound to teachers who served K–12 students in the United States due to the lack of sufficient experience and available professional development opportunities in the country (Kim & Kim, 2022). Therefore, information from participants who did not reside in the United States was excluded. In addition, the selection of K–12 teachers for the study was a

delimitation because there were multiple existing studies addressing higher education faculty and institutions (du Boulay, 2019; Karaci et al., 2018; Kulik & Fletcher, 2016; Xu et al., 2019*)*.

Similar to delimitations, scope outlines the boundaries set by the researcher in a study (Peoples, 2021). The scope of the study was limited to 15 teachers who serve in K–12 schools in the United States who were contacted via social media postings. The findings from the study should be transferable because the detailed descriptions provided by participants may be similar to other populations, such as teachers from other countries (Peoples, 2021). In addition, the integration of artificial intelligence applications mirror technology integration of tools like augmented reality and virtual reality (Siegle, 2019; Steele et al., 2020). The participants' lived experiences related to professional development focused on artificial intelligence may parallel instances of professional development addressing topics from technology integration to the science of reading (Kao et al., 2020).

Limitations

According to Peoples (2021), limitations in qualitative phenomenological studies refer to anything outside the researcher's control. Limitations that impact transferability include bias resulting from researcher beliefs that differ from participants in the study. Bias can be monitored by maintaining a reflexive journal with detailed descriptions (Weatherford & Maitra, 2019). There were also limitations in administering the demographic questionnaire, which was distributed online via Google Forms because potential participants could have had issues accessing or submitting the form. To address issues with Google Forms, participants were guided to use Google's online technical support system.

The study relied on the ability of participants to provide accurate responses to interview questions and questionnaires Participants could provide inaccurate responses outside of the interviewer's control. Untrustworthy responses can negatively impact dependability because

trustworthiness is important to ensure the study's findings are reliable (Peoples, 2021). Triangulation through multiple sources such as questionnaires and interviews minimized challenges to dependability because data could be compared and analyzed to find commonalities (Coleman, 2021).

Chapter Summary

Emerging technologies powered by artificial intelligence are being introduced into K–12 learning environments (Oster et al., 2021). Many teachers lack the necessary skills to implement tools such as artificial intelligence applications with fidelity (Kim & Kim, 2022; Prahani et al., 2022). Exploring the knowledge and perceptions of K–12 teachers working in the United States and implementing artificial intelligence applications and related professional development should provide insights that can guide planning and teacher support (Tanguihan, 2021).

The significance of the qualitative phenomenological study rests on the potential to expand knowledge regarding the lived experiences of K–12 teachers implementing or preparing to implement artificial intelligence and related professional development. Research questions related to participants' lived experiences were examined through the lens of constructivism and the stages of concern from the concerns-based adoption model. To further increase understanding of the lived experiences of participants, relevant terms were identified and defined (Peoples, 2021).

Assumptions center on the potential for bias and employing bracketing to set aside judgment (Peoples, 2021). Participants providing accurate responses when completing questionnaires and knowledge of artificial intelligence were also assumptions. Delimitations focused on using a private social media group for recruiting participants and developing a questionnaire and interview questions to collect data. Limitations outside the researcher's control

included bias and using Google Forms. Potential impacts on transferability and dependability were examined when considering assumptions, delimitations, and limitations.

A review of literature outlining the foundations of artificial intelligence to the connections to modern learning environments will be explored in Chapter 2. Details will be provided about the literature search strategy and the theoretical frameworks of the study. Gaps in the literature will be identified, and implications for future research will be provided.

Chapter 2: Literature Review

The shift to virtual learning during the COVID-19 pandemic revealed several issues surrounding education and technology integration (Al-Rohaimi & Al Otaibi, 2020). Many school districts struggled to provide the necessary access and resources for virtual learning due to the shortage of technology for students (Oster et al., 2021; Oyeniran & Oyeniran, 2020). Teachers planned virtual lessons through the lens of in-person instruction but lacked the knowledge of best practices in online education delivery and artificial intelligence (AI) applications (Oster et al., 2021).

The problem was K–12 teachers lacked sufficient experience and professional development opportunities to implement artificial intelligence in classroom environments effectively in the United States (Kim & Kim, 2022). The purpose of the study was to explore K–12 teachers' lived experiences with implementing or preparing to implement artificial intelligence and the professional development needed for implementation.

Artificial intelligence (AI) applications in education are not new; intelligent tutoring systems (ITSs) and intelligent learning environments (ILEs), which use artificial intelligence techniques, have been in existence for over 40 years (du Boulay, 2019). There are numerous studies on these foundational AI applications and how they benefit students (Holmes et al., 2019). Studies detailed other emerging AI applications, including chatbots, robots, and personalized learning programs (Holmes et al., 2019; Tang et al., 2019; Walsh, 2018).

Although the literature presented the promise of AI's future in education, some challenges and considerations could impede the development and implementation of AI educational applications. Given that AI requires algorithms and considerable amounts of data for its applications, privacy implications, the potential for bias, and other ethical concerns should be considered (Huang et al., 2021; Weinstein, 2020). In addition, there are indications that AI or AI-

powered robots could replace teachers, leaving students without the social and emotional support humans provide (Edwards & Cheok, 2018; Kolchenko, 2018).

Details on artificial intelligence applications from their beginnings to their current roles in education are included in Chapter 2. The literature search strategy details the resources used to gather information about the research topic. Explorations of the theoretical framework of constructivism and the stages of concern from the concerns-based adoption model (CBAM) guide considerations of assimilation, accommodation, or adoption. These theories also provide a foundation for studying the future impact of AI in K–12 schools in the United States of America and for students, including Generation Alpha.

Literature Search Strategy

The American College of Education library databases (EBSCO, ERIC, and ProQuest) were used to research artificial intelligence and its potential impact on education. JSTOR was another database used to research the topic and provided access to thousands of journals and other publications. The search criteria for the American College of Education's library databases and JSTOR were limited to full-text and peer-reviewed journal articles fewer than 5 years old. Google is a search engine used to gather general information on the research topic. Comprehensive searches for literature on the topic are essential to determine which resources can contribute to an examination and if refinement is necessary (Machi & McEvoy, 2022).

The initial phrase used to search the topic was *artificial intelligence in education*, which yielded more than 50 relevant journal articles. Many articles focused on higher education or specific fields, concentrating on computer science or related areas. Additional keywords and phrases used to gather articles for research include *artificial intelligence textbooks*, *automated speech recognition*, *augmented reality*, *ChatGPT*, *concerns-based adoption model*, *cognitive constructivism*, *constructivism*, *deep learning*, *Education 4.0*, *ethics*, *industrial revolution*,

intelligent learning systems, *machine learning*, *neural networks*, *personalized learning*, *primary and secondary learners*, *social constructivism*, *technology integration models*, and *virtual reality*.

Theoretical Framework

This study was informed by constructivism theory, credited to Jean Piaget and rooted in research on cognitive development (Hanfstingl et al., 2019; Piaget, 1994). Piaget (1994) posited that students acquire new information when they are active participants in the learning process and connect new information to prior knowledge. There are two significant constructivism divisions: cognitive constructivism and social constructivism (Finnegan & Ginty, 2019; Zhang & Lin, 2018). Despite distinctions between cognitive constructivism and social constructivism, there are core components relevant to a review of artificial intelligence and its potential impact on education (Finnegan & Ginty, 2019; Zhang & Lin, 2018).

Constructivism

Through cognitive constructivism, students learn when they construct their knowledge as a function of active participation in learning and prior experience–or schema (Zhang & Lin, 2018). During the learning process, students may assimilate or accommodate new information. (Zhang & Lin, 2018). Assimilation means that the student will take and incorporate new information into the existing schema (Sruthi & Mukherjee, 2020). Under the accommodation, a student will use new information to refine or revise the schema (Sruthi & Mukherjee, 2020). When considering the constructivist approach and AI applications, teachers will either assimilate those applications to fit within existing environments or accommodate AI applications to transform educational settings (Sruthi & Mukherjee, 2020; Zhang & Lin, 2018).

Social constructivism, credited to Lev Vygotsky, complements cognitive constructivism by incorporating social interaction with individuals such as teachers and peers as a component of

knowledge acquisition (Finnegan & Ginty, 2019). In contrast to Piaget, Vygotsky (1978) proposed that social interactions such as collaboration were necessary components of the learning process. Social constructivism places greater importance on the social aspects of learning, including interactions with someone with more knowledge (Clark, 2018). Given the social aspects of educational environments, this component of constructivism should be considered in conjunction with the cognitive elements of assimilation or accommodation (Clark, 2018; Finnegan & Ginty, 2019).

Concerns-Based Adoption Model

Whereas constructivism focuses on how learners acquire knowledge, the concerns-based adoption model (CBAM) centers on the processes of implementing change (Trapani & Annunziato, 2018). Initially developed by researchers Hall and Hord (1978), CBAM employs three instruments to measure aspects of change specific to teachers: stages of concern (SoC), levels of use (LoU), and innovation configurations (IC). Min (2017) noted that CBAM is often used for adoptions mandated by others and without teacher input. The current trajectory of AI applications indicates that teachers may not have a choice in learning about or implementing AI applications; therefore, CBAM is an appropriate resource for this literature review.

In particular, the stages of concern (SoC) of CBAM outline seven progressive levels, outlined in Figure 1, which teachers face throughout an innovative adoption that results in change, categorized into three areas: self, task, and impact (Hall et al., 1978). Traditionally, SoC can be measured using the SoC questionnaire (Trapani & Annunziato, 2018). Interviews are an alternative method of obtaining SoC data, and results can be interpreted by aligning themes with SoC levels or by mapping strategies with CBAM (Haines, 2018; Min, 2017).

Figure 1

Levels of Stages of Concern

Impact	6	**Refocusing**	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	**Collaboration**	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	**Consequence**	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students, the evaluation of student outcomes, including performance and competencies, and the changes needed to improve student outcomes.
Task	3	**Management**	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
Self	2	**Personal**	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	**Informational**	The individual indicates a general awareness of the innovation and interest in learning details about it. The individual does not seem worried about himself or herself in relation to the innovation. Any innovation is in impersonal, substantive aspects of the innovation, such as its characteristics, effects, and requirements for use.
	0	**Unconcerned**	The individual indicates little to no concern about or involvement with the innovation.

Note. The Stages of Concern about an Innovation. Reprinted from *Measuring implementation in schools: The stages of concerns questionnaire* (pg. 8) by A. A. George, G. E. Hall, & S. M. Stiegelbauer. Copyright 2013 by Southwest Educational Development Laboratory. https://sedl.org/cbam/socq_manual_201410.pdf. Reprinted with permission (see Appendix A and Appendix B).

Research Literature Review

There is a lack of peer-reviewed, research-based content about K–12 teachers' perceptions of the impact of artificial intelligence (AI) in educational environments based on their lived experiences (Zawacki-Richter et al., 2019). The lack of information impacts decision-making regarding technology integration with AI (Owoc et al., 2021). Synthesizing sound research is necessary for K–12 decision-makers as they make determinations regarding large-scale implementation of artificial intelligence applications (Bajaj & Sharma, 2018).

The literature review is divided into the following sections: (a) the potential impact of artificial intelligence in education, (b) artificial intelligence and ethical considerations, (c) artificial intelligence and Education 4.0, (d) artificial intelligence and personalized learning, (e) artificial intelligence replacing teachers, (f) teachers' support through artificial intelligence systems, (g) using artificial intelligence to make predictions in education, (h) artificial intelligence in specific courses and content, (i) teacher perception of AI in higher education and K–12 systems, (j) Generation Alpha, and (k) common threads of concern. Each of these topics will be discussed in turn.

The Potential Impact of Artificial Intelligence in Education

In 1950, mathematician Alan Turing posed a deceptively complex question in his seminal article, Computing Machinery and Intelligence: "Can machines think?" (p. 433). Turing (1950) devised the imitation game, better known as the Turing Test, as a measure to determine a computer's intelligence. The gist of the imitation game was that given a series of questions and responses, a person would not distinguish the computer from a human (Turing, 1950).

Five years later, four scientists–McCarthy, Minsky, Rochester, and Shannon–submitted a proposal: *The 1956 Dartmouth Summer Research Project on Artificial Intelligence* (1955). The group proposed a study based on the conjecture that machines could learn and perform intelligent

tasks (McCarthy et al., 1955). Their convening to discuss the artificial intelligence problem is recognized as the foundation for the field of artificial intelligence (Popenici & Kerr, 2017).

The work of Turing and the Dartmouth Summer Research Project group offered a preliminary framework for artificial intelligence (AI) in education (Popenici & Kerr, 2017). Based on the Turing Test (Turing, 1950), AI-based systems should interact in ways that make them indistinguishable from humans. Through the work of McCarthy et al. (1955), AI-based systems should be able to learn and perform tasks like humans.

Initially, AI applications were limited to research laboratories and government agencies (Pierce & Hathaway, 2018). In the late 1960s, AI-based applications entered the realm of higher education through Intelligent Tutoring Systems (ITSs) and Intelligent Learning Environments (ILEs; du Boulay, 2019; Kulik & Fletcher, 2016). Traditionally, ITSs and ILEs served students in one-on-one learning environments; students interacted with these AI-based applications that scaffolded experiences to increase knowledge (du Boulay, 2019). The ITSs and ILEs resulted in positive student achievement outcomes in K–12 and higher education environments (du Boulay, 2019; Karaci et al., 2018; Kulik & Fletcher, 2016; Xu et al., 2019*)*. Concerns remain regarding overall effectiveness, teacher (human) interaction, and student privacy (du Boulay, 2019; Xu et al., 2019).

As AI began to advance, a branch of the system named machine learning, in which computers learn based on code, began to gain prominence because of its ability to match human adults' proficiency (Pierce & Hathaway, 2018). Other components of AI have been developed to complement machine learning, including neural networks and deep learning (Muniasamy & Alasiry, 2020). Neural networks include an input layer, a hidden layer, and an output layer and are comprised of artificial neurons, also known as nodes (Muniasamy & Alasiry, 2020). Through

neural networks, computers can train themselves to learn from data input, which is the essence of deep learning (Muniasamy & Alasiry, 2020).

From its humble beginnings as the ponderings of Alan Turing, AI was primed to support Generation Alpha, students born during or after 2010 (Holmes et al., 2019; McCrindle & Fell, 2021). AI is well-suited to support Education 4.0, a framework characterized by its ability to adapt continuously to learners' needs (Almeida & Simoes, 2019). As a result, educational institutions could reimagine instructional models through constructivist accommodation where AI-based systems are the primary driver of students' academic experiences (Mota-Valtierra et al., 2019). Stakeholders will need to consider if AI-based applications will benefit their students and meet operational goals (Holmes et al., 2019).

K–12 and higher education institutions use AI-based applications such as chatbots and tutoring systems (Holmes et al., 2019). To support these systems, corporations are funding projects to expand the number of available applications (Holmes et al., 2019). There is a possibility that artificial intelligence could completely disrupt existing educational models in favor of models that are more agile and intuitive with regard to meeting students' needs (Holmes et al., 2019). As AI expands further into education, exploring the ethical principles highlighted by authors could help decision-makers frame implementation guidelines (Huang et al., 2021).

Artificial Intelligence and Ethical Principles

If artificial intelligence (AI) transforms traditional models of educating students (Holmes et al., 2019), stakeholders and policymakers should consider the ethical implications behind the processes that fuel AI (Huang et al., 2021). There are principles to guide how educational systems could address AI when engaging in policymaking and curriculum planning (Huang et al., 2021). Given its prolific growth, there are also wonderings about the adequacy of ethics guidance with AI (Morley et al., 2020).

Part of the debate stems from the question of who should lead the work: ethics scholars or AI practitioners (Nourbakhsh, 2021). Researchers are also considering how to identify issues appropriately upon which to base ethical models because of the need for clarity regarding comparisons between human intelligence and artificial intelligence (Hildt et al., 2020). In response, some governments, nonprofit organizations, academic institutions, and corporations have published over 80 AI ethics guidelines centered on five major principles: "(1) transparency/explainability, (2) justice and fairness, (3) non-maleficence, (4), responsibility, and (5) privacy" (Hildt et al., 2020, p. 2376).

Hagendorff (2020) suggested certain guidelines result from the desire to minimize opposing views and promote self-regulation through in-house accountability. There is a consensus among several researchers that several published AI ethics principles are vague, misaligned, or antithetical to actual practice (Canca, 2020; Hagendorff, 2020; Khan et al., 2021). Some principles focus on problems, such as privacy, where systems for creating solutions are in place (Hagendorff, 2020). Canca (2020) posited that some AI principles are inadequate for decision-making or solving complex ethical concerns.

Despite concerns surrounding published AI principles, Morley et al. (2020) described how to apply these principles to promote best practices. In addition to the significant principles listed previously, expanded and more accessible considerations include autonomy, bias, discrimination, and morals (Hildt et al., 2020). Uncertainty remains, and there are still more ethical questions than answers in many industries that use AI applications, including education (Hildt et al., 2020).

In their review of constructivism and artificial intelligence, Apiola and Sutinen (2020) posited that ethics principles must balance students' engaging in their own learning processes and dilemmas such as access to students' actions and information. Protecting student data is

already a primary focus of educational policy (Weinstein, 2020). The Family Educational Rights and Privacy Act of 1974 (FERPA) regulates the sharing of personally identifiable student data (Archambault, 2021). Some educational institutions still struggle with FERPA compliance, particularly when providing students access to online educational technology or outsourcing data protection (Archambault, 2021). Given that AI and its subsets (machine learning, deep learning, and large language models) require large amounts of data to operate applications, guidelines should be in place to protect student information (Weinstein, 2020).

Although the adoption of educational policies specific to AI may become necessary, there is also a need to consider ethics in AI course design (Huang et al., 2021). There are two areas where AI ethics could be a factor: specific ethics courses that focus on AI and systems that use AI applications (Burton et al., 2017; Jobin et al., 2019). Instructional designers who use AI applications may have to review policies and regulations to guide decision-making on the types of AI applications used (Huang et al., 2021). Burton et al. (2017) recognized that the lack of solid foundational principles might lead course designers to build more solid AI ethics frameworks.

For ethics courses that include AI as part of the curricular focus, Burton et al. (2017) recommended posing questions that promote critical thinking and discussion about the implications of interactions between AI and humans. By posing questions, students should have the opportunity to construct new ways of thinking about AI ethics (Jobin et al., 2019). A constructivist approach that incorporates students' views into the learning process would promote a deeper understanding and acceptance of AI's role in society (Gerdes, 2018).

Instructional designers who rely on AI applications will have to review the applicable set board policy (Weinstein, 2020). When creating AI applications, designers will consider (a) if the AI application meets parameters to protect student data, (b) if the AI application is designed to

avoid bias and discrimination, and (c) the barriers potentially preventing students from accessing the AI application (Burton et al., 2017; Gerdes, 2018; Huang, 2021; Weinstein, 2020). Designers may also have to iterate designs to align objectives with ethical principles (Weinstein, 2020).

Authors indicated that the world of education would face the AI ethics conundrum on multiple fronts (Burton et al., 2017; Gerdes, 2018; Huang, 2021; Weinstein, 2020). Institutions will set policies based on a combination of the foundational principles previously discussed, such as bias, privacy, and transparency (Huang et al., 2021). Curriculum developers and course designers can incorporate ethics when creating courses or resources, or they will make AI the focus of those courses and resources (Burton et al., 2017). Teachers will also consider the ethics driving AI applications when deciding on the resources they use to facilitate learning (Lameras & Arnab, 2021). Students will potentially be the beneficiaries of sound AI ethics, either through the protections provided or through the knowledge gained in educational environments shaped by Education 4.0 (Almeida & Simoes, 2019; Gerdes, 2018; Leaton Gray, 2020).

The Industrial Revolution, also known as the Industrial Age, has been marked by four distinctive stages. Development of steam power defines the first stage, and the second stage ushered in electricity and mass production. Widening dependence on computers and the emergence of web-based technologies marked the third stage (Caudill, 2020; Moloi & Mhlanga, 2021). Researchers noted that society is now experiencing the fourth stage, in which robots, automation, and connectivity are powered by artificial intelligence and its related systems (Caudill, 2020; Jung, 2020; Moloi & Mhlanga, 2021).

Industry 4.0, the term coined by German professor Wolfgang Wahlster to describe this stage of technological advancement, may disrupt many facets of society in the coming years (Jung, 2020). Many jobs and professions performed by humans may be replaced by automation or omitted altogether (Skhephe & Mantlana, 2021). As a result, people may have to learn skills

to gain and maintain employment (Caudill, 2020). To meet this need, educational systems should adapt to prepare students for a technology-driven society (John et al., 2021).

Like the Industrial Age, education has also transitioned through four stages of transformation. Education 1.0 relied on written and oral assessments to demonstrate knowledge; Education 2.0 introduced projects developed through group collaboration; and Education 3.0 focused on social networks as a vehicle for more open learning environments (Almeida & Simoes, 2019; Moloi & Mhlanga, 2021). According to Almeida and Simoes (2019), Education 4.0 complements Industry 4.0 because the paradigm aims to prepare students for the future through agile learning models with AI as a primary driver.

Education 4.0 is characterized by smart education and student empowerment: this stage is related to constructivism because students can choose when and how they learn (Moloi & Mhlanga, 2021). Educational technologies adapt to students' levels and learning styles to meet their specific needs (Moloi & Mhlanga, 2021; Moloi & Salawu, 2022). Online and virtual learning environments exist alongside traditional classrooms, with the former providing more opportunities for exploration and student autonomy (Skhephe & Mantlana, 2021). Teachers will facilitate or support student learning more than providing direct instruction (Moloi & Mhlanga, 2021; Moloi & Salawu, 2022).

The convergence of Industry 4.0 and Education 4.0, coupled with the shifting landscape of education, intensified the need for solid policies grounded in ethical principles (Moloi & Salawu, 2022). Artificial intelligence (AI) is not a random concept best left for future generations to address (Almeida & Simoes, 2019; Moloi & Mhlanga, 2021; Moloi & Salawu, 2022; Skhephe & Mantlana, 2021; U.S. Department of Education, 2023). Stakeholders should continue to prepare for the impact of artificial intelligence applications (Almeida & Simoes, 2019; Moloi & Mhlanga, 2021; Moloi & Salawu, 2022; Skhephe & Mantlana, 2021). Since personalized

learning is a model that teachers can use to incorporate student choice and AI-powered systems, the model can show the potential impact of Education 4.0 (Walsh, 2018).

Artificial Intelligence and Personalized Learning

Education 4.0 promotes a student-centered approach (Moloi & Mhlanga, 2021). Lam et al. (2021) defined personalized learning as a pedagogy aligned with constructivism because the framework focuses on individual student needs and provides opportunities for students to connect prior knowledge to new concepts. Personalized learning is a multifaceted, student-centered approach designed to meet all learners' needs based on a set of factors, including interest, learning styles, and academic achievement (Arrowsmith et al., 2021; Walsh, 2018). Traditionally, personalized learning consisted of designing knowledge acquisition pathways that matched learners' strengths (Maghsudi et al., 2021). As personalized learning expanded, educational institutions invested in systems that made adopting the approach more efficient and adaptive to students' needs (Tang et al., 2019; Walsh, 2018). Unlike other computer-based solutions, AI-powered applications efficiently reach and serve many students (Walsh, 2018).

Most AI applications personalize learning through recommender systems, and programs that suggest pathways based on learner needs or interests (Maghsudi et al., 2021; Tang et al., 2019). AI-powered recommender systems also offer reinforcement by providing options to continue learning based on how students perform on a particular assignment or assessment combined with the materials used when learning (Tang et al., 2019). Students who engage in personalized learning perform at higher levels because they are active participants in the learning process (Arrowsmith et al., 2021; Maghsudi et al., 2021; Tang et al., 2019).

There is agreement about the benefits of AI-powered personalized learning (Arrowsmith et al., 2021; Maghsudi et al., 2021; Tang et al., 2019; Walsh, 2018). Students can access resources related to specific needs anytime and anywhere (Tang et al., 2019). Educational

institutions save money because fewer people are needed for student learning and support (Maghsudi et al., 2021). With AI applications supporting students through digital technologies, teachers have more time to coach students and deliver individualized instruction (Netcoh & Bishop, 2017; Tang et al., 2019; Walsh, 2018).

Challenges of AI and Personalized Learning

In a comprehensive review of personalized learning programs, Arrowsmith et al. (2021) revealed variations in the definition of personalized learning among school districts. These variations led to inconsistencies in district planning and implementation (Arrowsmith et al., 2021). Although there is a potential for savings through reduced personnel, funding inequities could prevent poorer school districts from investing in AI-powered, personalized learning systems (Maghsudi et al., 2021).

Another challenge facing AI applications and personalized learning is the amount of data needed to develop powerful algorithms (Tang et al., 2019). Companies that design AI applications may be limited in the types of student data collected due to existing policies, ethics concerns, or family choices (Regan & Jesse, 2019). Given the accelerated pace of AI expansion, the types of data needed could shift, causing delays in supporting students (Bingham et al., 2018).

Authors suggested teacher capacity is an issue when implementing personalized learning, mainly when using digital technologies such as AI applications (Arrowsmith et al., 2021; Bingham et al., 2018; Maghsudi et al., 2021; Regan & Jesse, 2019; Tang et al., 2019). In the absence of job-embedded training and support, teachers may resist personalization efforts or revert to preferred methods of instruction when challenges arise (Bingham et al., 2018). The level of training involved in to shift from direct instruction to personalized learning may increase

teachers' workloads, which can lower morale and lead to teacher turnover (Bingham et al., 2018).

In a qualitative study on teachers' perceptions of personalized learning, Maghsudi et al. (2021) noted that teachers did not have input on the implementation in their districts. Duren et al. (2021) incorporated the stages of concern (SoCQ) and levels of use (LoU) questionnaires from the concerns-based adoption model (CBAM) to observe faculty members' feelings and concerns about personalized learning. Faculty were curious about adaptive technologies that promoted personalized learning, but the study also reinforced the notion of reversion to familiar methods when faced with challenges (Duren et al., 2021).

Authors implied that the advances in AI-powered, personalized learning or similar adaptive models would continue (Arrowsmith et al., 2021; Duren et al., 2021; Maghsudi et al., 2021). Decision-makers at educational institutions must consider potential challenges, including costs, student privacy (data), and teacher training (Arrowsmith et al., 2021). Administrators should consider involving teachers in decision-making to promote buy-in and increase motivation (Duren et al., 2021). Teachers' input is critical when AI-powered applications are considered for personalized learning and as a solution to address teacher shortages (Edwards & Cheok, 2018).

Artificial Intelligence Replacing Teachers

Industry 4.0 could potentially shift or eliminate existing jobs and careers (Skhephe & Mantlana, 2021). Education is not immune to this premise, and there is a growing concern about AI replacing teachers (Barakina et al., 2021; Popenici & Kerr, 2017). The reliance on online and remote learning during the COVID-19 global pandemic revealed how digital technologies could support or augment instruction during teacher absences (Al-Rohaimi & Al Otaibi, 2020;

Kolchenko, 2018). Proponents of AI replacing teachers offered the idea as an efficient and cost-effective solution to combat teacher shortages (Edwards & Cheok, 2018).

Despite the potential of solving teacher shortages with AI applications, there are varying views on the best approach for AI-facilitated learning environments. Some researchers envision AI-powered robots facilitating classroom learning (Huang, 2021; Leoste et al., 2021). The NAO educational robot system was developed to help students learn English vocabulary and use it in primary and middle-grade classrooms (Huang, 2021). Zenbo is an intelligent robot that features natural learning processing and can display multiple expressions: the robot deploys games for student learning (Chen et al., 2021). PLEA is a social robot head that has been designed to facilitate learning in higher education settings (Stipancic et al., 2021).

Integrating AI-powered robots within classroom settings can increase student motivation and improve student outcomes (Salas, 2020). Other authors demonstrated there are additional ways AI could potentially replace teachers (Cai et al., 2021; Kolchenko, 2018; Stipancic et al., 2021). Students could learn content through computer-based AI applications, alleviating the need for full-time teachers (Kolchenko, 2018). Interactions with AI programs that display human-like facial expressions and communication skills are another option for students (Stipancic et al., 2021). Conversely, students could engage in virtual reality (VR) or augmented reality (AR) classrooms, interacting with peers in the metaverse (Cai et al., 2021). Instructional facilitators could support students who require technical assistance or similar types of support (Salas, 2020).

Dandalt (2021) explored the potential benefits of personalized learning and AI for educational institutions or school districts that may use AI robots or AI applications. As with other industries where AI is prevalent, there has been a reduction in payroll costs due to technology investment (Tschange & Almirall, 2021). AI could reduce the need for ancillary

systems such as human resources, benefits, and health insurance (Dandalt, 2021; Tschange & Almirall, 2021).

There is one factor that may hamper the progression of artificial intelligence replacing teachers. Overall, researchers from the studies indicated AI lacks the human quality of emotional intelligence and cannot efficiently adapt to nuances in students' actions or behaviors (Edwards & Cheok, 2018; Kolchenko, 2018). Many students are more motivated and perform better when they interact with human teachers (Kolchenko, 2018). Advances in artificial intelligence and the passage of time will reveal if Kolchenko's belief that teachers cannot be replaced or Edwards' and Cheok's alternative views will prevail. Another alternative may be AI-powered systems that support teachers instead of replacing them (Popenici & Kerr, 2017).

Teacher Support Through Artificial Intelligence Systems

In recent years, teachers have been assigned additional responsibilities that exceed their classroom duties (Ehren et al., 2021; Murphy, 2019). On any given day, teachers may serve as de facto caseworkers for students with special needs, document student behaviors, assess academic performance, and monitor students during lunch periods and before and after school (Murphy, 2019). In addition to extra duties, teachers face increased class sizes, students with various learning abilities, and testing requirements that impact planning and instructional time (Murphy, 2019; Räsänen et al., 2020).

Teachers cited the increase in responsibilities as a major reason for job dissatisfaction (Goe et al., 2020). As a result of COVID-19, teachers helped students combat learning loss, which put additional strain on tight schedules (Ehren et al., 2021). In addition to closing gaps caused by learning loss, teachers had to learn new technologies to support remote and online learning (Ehren et al., 2021). Due to fulfilling extraneous duties, teachers have less time to

complete traditional tasks such as lesson planning, lesson delivery, and professional development (Goe et al., 2020).

As a result of increased workloads and growing dissatisfaction, teachers are leaving the profession at an accelerated pace (Räsänen et al., 2020). While teachers leave the profession to work in other industries, many districts have been unable to recruit new teachers or fill substitute positions (Han & Hur, 2022). Despite the rise in turnover, findings showed that teachers are more likely to stay in the profession if they have adequate support (Ehren et al., 2021; Goe et al., 2020; Han & Hur, 2022; Murphy, 2019).

Artificial intelligence applications offer solutions to support teachers in face-to-face and online learning environments (Marrhich et al., 2021; Popenici & Kerr, 2017). Teacherbots are AI programs that can provide access to content, give feedback to learners, and complete some of the administrative tasks usually assigned to teachers (Popenici & Kerr, 2017). Authors showed these systems are particularly useful in online learning environments; however, teachers can also use AI programs to differentiate instruction, provide feedback, and support student needs (Murphy, 2019; Popenici & Kerr, 2017). In addition to completing administrative tasks, AI systems reduce teachers' workloads by communicating with students and scoring student work (Marrhich et al., 2021; Murphy, 2019; Wang et al., 2021).

There are AI-powered solutions available to support teachers. Some higher education institutions have invested in chatbots to interact with students, give academic advice, and provide tutoring services (Gupta & Chen, 2022). Grading software is available to score student assessments or review written assignments such as essays (Çekiç & Bakla, 2021; Yang et al., 2021). Tools such as TurnitIn® can analyze student work and check for grammatical issues and potential plagiarism (Mtshali, 2021).

Potential Barriers to AI-Powered Support

Some barriers may prevent teachers from benefiting from AI-powered support solutions. Teacher training is the most often-cited concern when considering the implementation of programs (Marrhich et al., 2021; Murphy, 2019; Wang et al., 2021). Even when training is available, the content may not be comprehensive enough to promote consistent usage of programs (Marrhich et al., 2021). After analyzing the stages of concern in a CBAM study, Lochner et al. (2015) found that teachers needed to feel that they were involved in the adoption of a learning management system to increase buy-in. When considering constructivism, teacher involvement may be the difference in whether AI is assimilated into the classroom or if teachers use AI-powered support to transform classrooms (Sruthi & Mukherjee, 2020; Zhang & Lin, 2018).

Another potential barrier is the cost associated with AI-powered technologies (Maghsudi et al., 2021). Cash-strapped school districts and higher education institutions cannot invest in AI solutions (Maghsudi et al., 2021). If the trend of teacher turnover continues, there may be a need to seek out technological solutions for support (Maghsudi et al., 2021). One possible support solution that may alleviate teacher shortages is the ability of AI to make predictions related to student support and progress (Alkhasawneh & Hargraves, 2014).

Using Artificial Intelligence to Make Predictions in Education

School district administrators constantly seek ways to improve students' academic achievement (Alkhasawneh & Hargraves, 2014; Deo et al., 2020). Administrators in institutions of higher learning want to ensure students have the support they need to reduce failures and dropouts (Deo et al., 2020). Despite current limitations with artificial intelligence in education applications, institutions can use artificial intelligence to make predictions regarding student performance (Alkhasawneh & Hargraves, 2014). These predictions can help districts and higher education institutions provide adequate support for students (Alkhasawneh & Hargraves, 2014).

Making accurate predictions using AI starts with data mining, which consists of collecting and analyzing large amounts of student data that result in models and algorithms designed to predict student outcomes (Alkhasawneh & Hargraves, 2014; Deo et al., 2020). Educational institutions can use the resulting models to provide interventions, such as tutoring or counseling (Alkhasawneh & Hargraves, 2014). Through targeted interventions, student achievement and retention should increase (Alkhasawneh & Hargraves, 2014; Deo et al., 2020).

Deo et al. (2020) studied student data performance in areas such as quiz grades and summative assessment scores during a period of 6 years. Researchers used the data to develop a predictive AI Extreme Learning Machine (ELM) model (Deo et al., 2020). Findings showed that the model accurately predicted the final examination scores and weighted scores for students in engineering math courses (Deo et al., 2020). The authors concluded that AI-based predictions could be used to support students through activities, interventions, and other measures designed to improve learning experiences (Deo et al., 2020).

Comparable studies yielded similar results. Parapadakis (2020) described how data mining and AI models were used to predict student satisfaction–a measure of the overall learning experience. Lu et al. (2021) analyzed a random forest (RF) model that maintained an accuracy of more than 90% when measuring potential academic performance. An early detection system studied by Rodríguez et al. (2022) revealed that students performed better when they received more nudges, a type of intervention when the system detected students at risk for failing. Predictive AI models have also contributed to a specialized form of constructivist personalized learning called precision education, connected to machine learning (Luan & Tsai, 2021; Yang et al., 2021).

Perceived benefits are similar to other areas of education where AI is gaining prominence, such as investment in AI technologies and teacher support and retention (Deo et al.,

2020; Parapadakis, 2020*).* Researchers espoused the cost benefits, informed choices, and effectiveness of support for students (Deo et al., 2020; Parapadakis, 2020*).* Making predictions to improve student outcomes is also aligned with the tenets of Education 4.0 because models are designed to address specific student needs (Almeida & Simoes, 2019).

Regarding opposing viewpoints, concerns about access and the safety of student data are at the forefront (Deo et al., 2020; Weinstein, 2020). Luan and Tsai (2021) expressed wonderings about the potential for bias or discrimination against minorities and underrepresented groups. Some apprehension stems from the potential emergence of tracking systems that could deny students opportunities under the guise of computer analysis (Luan & Tsai, 2021). The proliferation of various models without common understanding of concepts that govern AI-powered applications could potentially hamper progress instead of fostering growth (Wang et al., 2021).

Literature was limited regarding teachers' perceptions of predictive AI models. Wang et al. (2021) recognized teacher acceptance is essential for the successful implementation and continuity of AI-related higher education programming. There are positive perceptions among college counselors who benefit from AI-powered student management software (Yang & Talha, 2021). The application or implementation of AI applications is more prevalent in reviewed literature than the perceptions of teachers or faculty regarding AI programming (Wang et al., 2021; Yang & Talha, 2021). Perceptions of teachers or faculty extend to the courses and content they will provide for students (Kessler, 2018).

Artificial Intelligence for Specific Courses and Content

Artificial intelligence (AI) could potentially impact education through adaptive learning environments in specific courses (How & Hung, 2019; Kessler, 2018). Applications powered by artificial intelligence can also promote social interaction and collaboration in online

environments (How & Hung, 2019; Kessler, 2018). Various authors offered insights into the performance of particular AI applications such as automated speech recognition, AI-powered textbooks, gamification, augmented reality, and virtual reality (Dillon & Wells, 2021; How & Hung, 2019; Kessler, 2018; Pragt et al., 2022).

Automated Speech Recognition

Automated Speech Recognition (ASR) provides pronunciation assistance for learners practicing languages *(*Li & Spigner, 2021). Previously, students and teachers relied on Computer Assisted Pronunciation Training (CAPT), which many people had difficulty using (Dillon & Wells, 2021). The natural learning processing of AI has improved ASR, and findings show ASR is effective when used as part of classroom instruction (Dillon & Wells, 2021; Pragt et al., 2022).

Automated Speech Recognition systems are available in multiple digital formats, including smartphones (Li & Spigner, 2021). Most students in a K–12 study agreed that ASR is easy to use and accessible (Pragt et al., 2022). Improvements in automated speech recognition (ASR) have provided more opportunities for accommodations (speech-to-text), foreign language translation, and for hearing-impaired individuals (Kessler, 2018).

AI-Powered Textbooks

Many textbooks are available digitally and are accessible through computers, laptops, tablets, and even smartphones (Dixon, 2020). Textbooks powered by AI offer features such as the ability to export notes, highlight important content, input questions, provide answers, and deliver feedback to students in subject-specific courses (Dixon, 2020; Koć-Januchta et al., 2020). AI textbooks are different from traditional e-books because of their intelligent and adaptive features (Dixon, 2020).

Koć-Januchta et al. (2020) studied the effectiveness of an AI-powered biology textbook and found that most students using the book were more engaged and satisfied with the course.

The researchers also found that self-regulated students performed better in the adaptive learning environment during the biology course (Koć-Januchta et al., 2020). A study involving elementary school students revealed no significant difference in performance when using an interactive ebook system or traditional printed books (Huang et al., 2012). Min (2017) studied teachers' perceptions of ebook integration through the stages of concern of the CBAM and found that teachers had positive views regarding integration but concerns about student access. There are also concerns regarding students and the cognitive load students face when encountering too much information, but the potential may outweigh those concerns (Koć-Januchta et al., 2020).

Gamification

Gamification incorporates aspects of game mechanics such as competition, levels, and rewards into educational environments (Choi & Park, 2021). Soboleva et al. (2021) noted that teachers use gamification for reinforcement or motivation and stress relief rather than as a tool for learning concepts. Academic achievement improves when gamification is part of the classroom experience (Choi & Park, 2021; Soboleva et al., 2021). Some examples include an elementary game with robots (Chen et al., 2021) or an AI-powered reinforcement game in a college physics course (Tan & Cheah, 2021).

Augmented Reality and Virtual Reality

Augmented reality (AR) and virtual reality (VR) are connected technologies that employ simulations of physical environments to create life-like experiences for users (Siegle, 2019). Augmented reality provides computer-generated images within real-world contexts and is accessible through smartphones, tablets, and laptops (Andone & Frydenberg, 2017). Virtual reality immerses participants in three-dimensional digital environments and requires the use of specialized headsets (Enis, 2018).

School districts and institutes of higher learning are increasingly using AR and VR to enhance classroom learning by incorporating the technologies into existing lessons or by allowing students to create their own immersive experiences (Siegle, 2019; Steele et al., 2020). Augmented reality and virtual reality are also used for administrative and operational purposes, such as eye-tracking to measure students' attentiveness during instruction (Mikhailenko et al., 2022). Authors showed that AR and VR are transforming learning experiences because students are actively participating in the learning process (Andone & Frydenberg, 2017; Cai et al., 2021; Enis, 2018; Siegle, 2019).

Like all AI applications, systems used for ASR, textbooks, gamification, and AR and VR will require student data to run effectively, which raises privacy concerns (Choi & Park, 2021; Dillon & Wells, 2021; Dixon, 2020; Koć-Januchta et al., 2020; Pragt et al., 2022*).* Automated Speech Recognition systems sometimes have issues recognizing voices and dialects of certain ethnicities, raising bias concerns (Markl & McNulty, 2022). Costs of acquisition, maintenance, and educator training also factor into educational institutions' choices regarding AI-powered systems and applications (Dillon & Wells, 2021; Pragt et al., 2022). In addition to teachers' perceptions regarding content and courses, their general insights regarding AI systems in higher education and K–12 can inform how AI implementation will occur.

Teacher Perception of AI in Higher Education and K–12 Systems

There is limited information on teachers' perceptions of AI systems, particularly focusing on K–12 learning environments and Generation Alpha (Kim & Kim, 2022; Weiwei, 2022). Faculty working in institutes of higher education are increasing usage of AI applications (Altinary et al., 2019; Bates et al., 2020). One study showed that in-service and preservice teachers in K–12 systems were algorithm averse, meaning they preferred advice from humans

rather than computer algorithms (Kaufmann, 2021). Training was recommended to build capacity on computerized expert models (Kaufmann, 2021).

There is agreement that teacher training and professional development are necessary components for implementing AI systems. Research involving 311 higher education teachers showed they were more likely to adopt AI systems in their classrooms if they had self-efficacy and the AI was easy to implement (Yang et al., 2021). Miranda Veiga and Valente de Andrade (2021) identified six critical success factors for accepting technology, including AI, in their study involving 119 primary and secondary teachers: (a) performance expectation, (b) effort expectancy, (c) ICT compatibility, (d) facilitating conditions, (e) the influence of facilities, and (f) peer influence.

Perceived usefulness and student motivation are other factors teachers consider when incorporating AI technology into their classrooms (Zhang et al., 2021). When teachers are experiencing difficulties with AI or related digital technologies, known as techno stress, they may resist implementation and prevent constructivist assimilation and accommodation, even with the availability of training and job-embedded professional development (Thiyagu & Joshith, 2021). Teachers also have to consider the characteristics of the students they serve, and these students include Generation Alpha (McCrindle & Fell, 2021).

Generation Alpha

The term Generation Alpha refers to students born during or after 2010, the majority of whom are the children of millennials (Ziatdinov & Cilliers, 2021). The emergence of Generation Alpha coincided with the launch of the iPad and signified the transformation into a fully digital age (Huth, 2020). Mark McCrindle, who coined the phrase, claimed that Generation Alpha is the most globally connected generation due to accessibility to the internet and to the devices needed to connect (McCrindle & Fell, 2021).

Students who comprise Generation Alpha are characterized by the amount of time they spend on screens, the preference for visuals and videos, and the fondness for smartphone-based messaging over vocal discussions (McCrindle & Fell, 2021). Due to the vast amounts of information accessible to Generation Alpha, students of this generation have shorter attention spans but can be easily influenced (Ziatdinov & Cilliers, 2021). Jha (2020) posited that Generation Alpha is more likely to be comfortable speaking with a device like Apple's Siri than a parent.

In a study of Generation Alpha students in preschool, Apaydin and Kaya (2020) found that although students were curious and had high self-esteem, they were also irritable and self-centered. Despite Generation Alpha's interactions on social media, students tend to be more individualized in learning environments (Jha, 2020). Spending time in remote and virtual learning during the COVID-19 pandemic contributed to Generation Alpha's tendencies toward isolation (Apaydin & Kaya, 2020; Jha, 2020).

Given Industry 4.0's reliance on artificial intelligence (Moloi & Mhlanga, 2021) and the recognition that Education 4.0 is predicated on educational technology and personalized learning (Almeida & Simoes, 2019), Generation Alpha may be well-suited to thrive (McCrindle & Fell, 2021). Generation Alpha's familiarity with technology and social media minimizes the time needed to acclimate students to online learning resources while maximizing the benefits of social constructivism (Jha, 2020; Ziatdinov & Cilliers, 2021). Personalized learning aligns with Generation Alpha's inclination toward individualism because the former works based on the unique needs of each student (Jha, 2020).

Teachers are a link between Generation Alpha and the AI-powered resources of Education 4.0 (Apaydin & Kaya, 2020). In many ways, teachers can influence students' attitudes toward AI and how much students interact with AI applications for learning purposes (Apaydin

& Kaya, 2020; Jha, 2020; Ziatdinov & Cilliers, 2021). Therefore, insights into teachers' attitudes toward AI are essential to determining AI's impact on learning environments (Apaydin & Kaya, 2020). Along with input from teachers, there are areas of concern that arise from the literature reviewed in this chapter.

Common Threads of Concern

Privacy issues, costs, bias and discrimination, and variations in understanding of concepts involving aspects of AI are concerns related to the implementation of AI in educational environments. These issues are connected to the foundational ethics of AI. Parameters should be set to alleviate these concerns as AI continues to progress (Weinstein, 2020).

As a counterargument to the proliferation of AI in education, a possibility exists that AI is a technological trend (Chen et al., 2022). Artificial intelligence may not have the potential impact suggested by the literature analyzed in this review (Chen et al., 2022; du Boulay, 2019). In the 1970s, artificial intelligence applications such as tutoring systems became popular, but interest in the field waned in the late 1980s (du Boulay, 2019). Given the complexities and potential costs of artificial intelligence applications, research outcomes could indicate negativity against this form of technology and could lead to another period of disinterest (Chen et al., 2022).

Chapter Summary

Artificial intelligence will either serve as a foundation for a reimagined education model for the future or fail to reach its potential (Channa et al., 2021). Studies on artificial intelligence's impact on Generation Alpha in educational environments are limited, particularly in K–12 education. Constructivism can guide how teachers approach artificial intelligence, either through assimilation or accommodation (Mota-Valtierra et al., 2019). The concerns-based adoption model (CBAM) can help provide insight into how teachers will react to artificial intelligence

initiatives, particularly when they are not part of the decision-making process (Wang et al., 2021).

Systems powered by artificial intelligence applications could replace or augment current educational technology forms in favor of innovative platforms (Holmes et al., 2019). Educational institutions could employ systems powered by artificial intelligence to solidify personalized learning (Khare & Stewart, 2018; Walsh, 2018). In terms of potential, artificial intelligence could provide the necessary support to teachers and serve as a solution to teacher shortages (Edwards & Cheok, 2018; Murphy, 2019).

Generation Alpha students, who are growing up in an increasingly digitized world, can benefit from the ability of artificial intelligence to make predictions about student performance (Alkhasawneh & Hargraves, 2014; How & Hung, 2019; Kessler, 2018; Koć-Januchta et al., 2020). Familiarity with technology will help Generation Alpha use adaptive learning systems such as automated speech recognition and AI-powered textbooks (Alkhasawneh & Hargraves, 2014; How & Hung, 2019; Kessler, 2018; Koć-Januchta et al., 2020). Ultimately, the opinions and attitudes of teachers and other stakeholders regarding artificial intelligence will drive its expansion in educational environments.

The research methodology used to explore K–12 teachers' lived experiences with implementing or preparing to implement artificial intelligence will be explored in Chapter 3. Details about the rationale for the study, procedures, and consent will also be addressed. Data collection and instrumentation are essential parts of Chapter 3 and include descriptions of data analysis.

Chapter 3: Methodology

School districts serving K–12 students in the United States of America face challenges ranging from student interventions to teacher shortages (Edwards & Cheok, 2018). To meet these challenges, K–12 educators must acquire the skills necessary to navigate an educational landscape driven by artificial intelligence (Holmes et al., 2019). Despite this necessity, teachers may not be adequately prepared for the shifting landscape or have adequate professional development in relevant artificial intelligence applications (Almeida & Simoes, 2019).

The problem was K–12 teachers lacked sufficient experience and professional development opportunities to implement artificial intelligence in classroom environments effectively in the United States (Kim & Kim, 2022). The purpose of the study was to explore K – 12 teachers' lived experiences with implementing or preparing to implement artificial intelligence and the professional development needed for implementation. The following research questions guided the study:

Research Question 1: What are teachers' lived experiences with implementing artificial intelligence applications in K–12 learning environments?

Research Question 2: What are teachers' lived experiences with professional development opportunities related to implementing artificial intelligence applications in K–12 learning environments?

Detailing the research methodology entails exploring the design of the study as well as the rationale for exploring teachers' lived experiences regarding artificial intelligence. Defining the role of the researcher, research procedures, and population samples will also be reviewed. A description of the instruments used to collect data are provided as well as how data were collected. Following data collection, elements of data analysis are included in addition to

highlighting the variability and reliability of the data. Ethical procedures involving protecting human subjects are explained.

Research Methodology, Design, and Rationale

To describe or explain questions related to a problem, selecting the appropriate research methodology is essential (Dubovicki & Topolovčan, 2020). Methodology refers to the system of principles forming the basis for justifying a particular method (Keenan, 2020). A specific methodology promotes rigor and consistency across research studies, including resulting findings (Bay, 2019).

Methodology

According to Creswell and Poth (2018), qualitative research provides insight and understanding of real-world issues. Qualitative research is helpful for a study related to education because of the ability to apply similar research techniques to realistic situations differing based on school culture or learning environment (Dubovicki & Topolovčan, 2020). The lack of teachers' sufficient experience to implement artificial intelligence applications in K–12 classroom environments effectively is a real-world issue (Kim & Kim, 2022; Weiwei, 2022).

Promoting a deep understanding of study topics viewed from the perspectives of participants is another benefit of qualitative research (Bloomberg & Volpe, 2019). Exploring K–12 teachers' lived experiences and related professional development may provide insight and understanding into a real-world issue. Therefore, the qualitative research approach is aligned with the purpose of the study.

Design

Phenomenology is the design for this study and serves as a foundation for the researcher to explore participants' lived experiences (Moustakas, 1994; Stolz, 2020). Understanding the meaning of a phenomenon through the lens of participants is a critical aspect of phenomenology

(Moustakas, 1994). In this study, phenomena refer to K–12 teachers' lived experiences of implementing or preparing to implement artificial intelligence applications in K–12 learning environments and the professional development needed for implementation. This study focused on K–12 teachers because artificial intelligence has been used in higher education since the late 1960s, but expanded use in K–12 learning environments is more recent (Altinary et al., 2019).

When studying the situations of individuals belonging to particular groups, phenomenology is appropriate (Tomaszewski et al., 2020). The principles of phenomenology can be explored to identify commonalities among the participants' lived experiences (Prosek & Gibson, 2021). Therefore, the commonalities of K–12 teachers regarding artificial intelligence applications and related professional development align with the problem and purpose of this study.

Since evidence is derived from the lived experiences of participants, in-depth interviews are appropriate for collecting data (Moustakas, 1994). In contrast, a case study relies on data from multiple sources, including interviews, observations, and documentation, which can significantly increase the time committed to completing data collection, triangulation, and analysis (Yin, 2018). Like case studies, employing grounded theory involves collecting data from multiple resources to explore complex changes, which can also lengthen the time for data collection and analysis (Urcia, 2021).

In contrast to quantitative studies, phenomenology is not used for comparisons or correlations, so the design is advantageous for researchers who seek to gain deep insights into participants' experiences with phenomena (Peoples, 2021; Tanguihan, 2021). Researchers are able to produce thick, detailed descriptions of participants' actions, feelings, and perceptions and provide meaningful interpretations (Rahman, 2017). Phenomenology is beneficial because

examinations of lived experiences can lead to transformations in how phenomena are understood (Neubauer et al., 2019).

Role of the Researcher

In this qualitative study, the role of the researcher was an observer who collected data from participants using interviews and an online questionnaire. I sought to understand the subject of qualitative research while being active, open, and reflective throughout the process (Bloomberg & Volpe, 2019). To avoid bias, researchers must only include the data provided by participants for analysis (Borowska-Beszta, 2017).

There was no relationship between the participants and me. People who worked with me were not eligible to participate in the study. I selected participants based on their willingness to complete interviews voluntarily and questionnaires after informed consent was given. Participants did not receive an incentive offer to complete the interviews or questionnaires. Therefore, minimal conflicts of interest existed between the participants and me.

Research Procedures

When conducting a qualitative study, procedures are necessary to ensure the safety of participants, the collection of data, and the analysis of participant contributions (Prosek & Gibson, 2021). Producing solid research results requires significant planning and consistency throughout the study (Johnson et al., 2020). Each step of the process holds considerable weight, so researchers must exercise diligence to avoid delays in data collection, flawed analysis, or preventable errors (Nair, 2021). American College of Education's Institutional Review Board (IRB) granted approval before data collection and analysis began (see Appendix C).

Population and Sample Selection

According to the latest report from the National Center for Education Statistics (2020), there were 3,169,762 elementary and secondary teachers serving in public schools in the United

States. The target population included 859 members of a private Facebook group focused on AI issues in education. Selected participants also engaged in snowball sampling to recruit others who met the study criteria. For inclusion in the study, participants had incorporated artificial intelligence into learning environments or were planning to integrate artificial intelligence into learning environments. Potential participants who did not meet the requirements were excluded. Participants in qualitative studies range from 15–20 individuals (Bloomberg & Volpe, 2019). According to Prosek and Gibson (2021), 15 participants are an adequate number for qualitative phenomenological studies, which aligns with the number of participants sought for this study. Therefore, the 15 participants sought for this qualitative phenomenological study were adequate.

Participants were informed of the study through a social media posting on LinkedIn and Twitter accounts detailing the purpose of the study along with the desired qualifications (see Appendix D). The LinkedIn post was accessible to at least 712 followers. The Twitter post was accessible to at least 842 followers. In lieu of site permissions, personal LinkedIn and Twitter accounts were used.

An email was sent to the project lead for the International Society for Technology in Education's (ISTE) AI Explorations group (see Appendix E). The project lead hosts a private Facebook group: ISTE AI and STEM Explorations Network. Permission was granted by the project lead to post on the Facebook group after IRB approval (see Appendix E).

In phenomenological research, participants should have experienced the phenomena being studied to inform the research problem (Creswell & Poth, 2018; Moustakas, 1994). Finding unknown participants who meet the criteria may be challenging (Ghaljaie et al., 2017). Therefore, a combination of sampling methods, such as criterion and snowball sampling, was used to obtain the planned number of participants (Peoples, 2021).

Criterion sampling is a purposive method involving the selection of participants who can provide details specific to the phenomena being studied (Creswell & Poth, 2018; Ezer & Aksüt, 2021). The criterion for this study included implementing or planning to implement artificial intelligence applications. Snowball sampling is a recognized method for recruitment when finding participants is challenging (Leighton et al., 2021). When engaging in snowball sampling, participants were asked via the social media posting to refer others who met the criterion. The combination of criterion and snowball sampling yielded the desired number of participants.

Participants who responded to the social media posting received detailed information through a link to an online form about the purpose of the study and the instruments used to collect data (see Appendix F). In research studies, informed consent is required (Manti & Licari, 2018). There was a detailed informed consent form included on an online form for participants to review and sign electronically (see Appendix G).

Data Instruments

Data collection in qualitative studies can occur through instruments, which are tools designed for interactions between researchers and participants (Canals, 2017). Selecting the appropriate instruments is based on several factors, including the purpose of the study, research questions, methodology, and the number of participants (Rivaz et al., 2019). Researchers can use questionnaires and interviews to collect data on teachers' lived experiences implementing or preparing to implement artificial intelligence in K–12 learning environments (Peoples, 2021).

Questionnaire

The questionnaire was comprised of questions to add context and substance to lived experiences and to gather information on experience with technology integration and implementing or preparing to implement artificial intelligence (see Appendix H). The questionnaire was administered online through Google Forms. Advantages of online

questionnaires include openness, flexibility, and access to a broader range of participants' views on the focus of the study (Braun et al., 2021). Given the availability of internet access, administering online questionnaires can capture hard-to-reach participants who meet research criteria (Panter-Brick et al., 2021). There is little to no cost associated with administering online instruments such as questionnaires (Braun et al., 2021).

Through the questionnaire, participants confirmed they were teachers working in the United States who were implement who were implementing or preparing to implement artificial intelligence. Participants' responses to questions regarding age, gender, subject taught, and level of technology experience provided context for writing rich, detailed descriptions. Participants also received a link via email to an online scheduler to set a time for an interview, which was the instrument used to collect data after participants gave informed consent and completed the questionnaire.

Interview

Participants who completed the demographic questions had the option to complete 10 open-ended questions through the online form or to receive an invitation for an interview via Zoom or Google Meet. The interview questions were created to ensure alignment with the research questions and elicit responses relevant to the study (Wegmeyer et al., 2022). Participants could complete the interviews through another agreed-upon conferencing application if Zoom or Google Meet were inaccessible. Conducting interviews via video conferencing applications was preferable to face-to-face interviews because the latter can be time-consuming and limit contributions from participants who are unable to meet in person (Twis et al., 2020).

The interview protocol (see Appendix I) was constructed to obtain deep descriptions of participants' lived experiences with incorporating artificial intelligence in learning environments

(Bloomberg & Volpe, 2019). Questions were open-ended to support participants' disclosure and elaboration of details relevant to the participants' lived experiences (Moustakas, 1994; Wegmeyer et al., 2022). Examples from Peoples (2021) and Moustakas (1994) began with the verbs describe and explain and were followed to design this study's interview prompts and questions.

Responses to the open-ended questions provided a deeper understanding of participants' experiences related to artificial intelligence in K–12 learning environments (Moustakas, 1994). Participants provided clarity and other details to the responses given while completing the interviews, which were audio recorded (Weller et al., 2018). Digital notes were taken during the interviews as well.

Field Testing

Subject matter experts (SMEs) are experts or practitioners in respective fields who can validate questions and research instruments (Elangovan & Sundaravel, 2021). Four SMEs were selected based on knowledge of technology integration in K–12 classrooms, development of online and in-person courses focused on coding and innovative technologies using artificial intelligence, and supervision of a district professional development department. An instructional technology specialist, a director of instructional technology, an electrical engineer, and an executive director of professional development were chosen as SMEs. None of the SMEs were associated with the American College of Education.

For this study, SMEs validated the questionnaire and interview prompts and questions through field testing (see Appendix J). The demographic questions were created to confirm participants' inclusion in the study and to support the development of in-depth descriptions (Peoples, 2021). Moustakas (1994) provided a basis for demographic questions in questionnaires, including names, gender, age-range location, and years of experience.

An email was sent to four SMEs to gather feedback on the interview and questionnaire questions (see Appendix J). All SMEs expressed interest in reviewing the demographic and open-ended questions. A follow-up email to SMEs included the purpose of the study, questionnaire and interview questions, and how to communicate suggestions and feedback. Adjustments were made based on input from the SMEs. None of the SMEs who reviewed the instruments participated in the study.

Data Collection

Data collection techniques for qualitative studies do not require in-person or synchronous methods (Jones et al., 2021). After potential participants responded to the recruitment communication, they were provided information about the study, the scope of research, an overview of the instruments, and informed consent (see Appendix G). Information provided also included details regarding IRB approval, ethics, and privacy considerations.

The first instrument used to collect data was the questionnaire, which was available through Google Forms (see Appendix H). Only participants who completed the informed consent document were able to access the questionnaire. After all participants completed the questionnaire, the ability for the Google Form to accept responses was closed.

Since the Google Drive account where responses were collected was password-protected, the confidentiality of the participants was protected. Upon completion of the questionnaire, participants had the option to respond to open-ended questions through the form or to schedule an interview through Calendly, an online appointment scheduling application, at convenient dates and times.

During the interviews, discussions were audio recorded through applicable video-conferencing applications such as Zoom or Google Meet, and notes on a digital Samsung Notes platform were taken to capture responses. A reflexive journal was maintained to monitor bias.

Once data were collected from 15 participants, responses were downloaded to a Microsoft Excel document. Microsoft Excel was the preferred software because of features which allowed users to sort and categorize data based on specific criteria (Frost et al., 2021). Exit procedures upon interview completion included responding to participants' questions and giving a reminder about how interviews were transcribed. Participants also received information on how confidentiality was maintained and when collected data will be destroyed.

Data Analysis

Data analysis commenced with organizing the information collected from interviews and questionnaires (Bloomberg & Volpe, 2019; Peoples, 2021). Interviews were digitally transcribed using Microsoft Word and a computer-assisted tool, NVivo. The coding process, which involves assembling, categorizing, and sorting data by themes, began upon completion of data collection (Williams & Moser, 2019). Coding is an intensive process requiring thorough, multiple reviews of transcribed data to identify recurring patterns representing themes (Bloomberg & Volpe, 2019; Saldaña, 2021). Creswell and Poth (2018) offered the data analysis spiral approach method, which includes the following steps: (a) managing and organizing the data, (b) reading and memoing emergent ideas, (c) describing and classifying codes into themes, (d) developing and assessing interpretations, and (e) representing and visualizing the data.

NVivo was used to aid in qualitative data analysis. Computer-assisted data analysis tools such as NVivo can efficiently divide data into categories and develop themes to aid in the data analysis process (Dalkin et al., 2021). According to Elliott-Mainwaring (2021), NVivo features the ability to upload different types of files that the software analyzes to support the coding process.

Transcripts were reviewed, and irrelevant information was omitted. As part of managing and organizing data, participants were assigned a random letter and number combination to

maintain anonymity (Creswell & Poth, 2018). Next, the transcripts were reviewed again, and notes were taken to begin identifying and grouping emergent ideas and experiences (Creswell & Poth, 2018; Moustakas, 1994). The participants' questionnaires and responses to open-ended questions were uploaded to NVivo as part of the process for sorting, arranging, and coding (Elliott-Mainwaring, 2021).

Information from NVivo was compared with notes to further the clustering process and grouping codes into themes (Creswell & Poth, 2018; Moustakas, 1994). The resulting themes were analyzed to respond to the research questions on the lived experiences of K–12 teachers related to artificial intelligence applications and related professional development based on their knowledge of the technology. Findings were represented as a narrative account along with any necessary visualizations showing the connection between the research questions and data analysis (Prosek & Gibson, 2021).

Reliability and Validity

Validity refers to maintaining integrity in the processes used when collecting and analyzing data (Jones & Donmoyer, 2021). Validity was established by following the procedures developed for the online questionnaire and interviews (Hayashi et al., 2021). Consistently collecting and analyzing data established reliability, meaning the same or similar results could be gathered by using the questionnaire and interviews under similar conditions (Ahmed & Ishtiaq, 2021).

Credibility

Credibility relates to the alignment of the participants' experiences with the researcher's portrayal of the participants' experiences (Bloomberg & Volpe, 2019). An essential process for establishing credibility in phenomenological studies is bracketing, whereby a researcher avoids inserting lived experiences into the collected data (Moustakas, 1994; Stolz, 2020). Bracketing

does not mean researchers can totally eliminate bias, but they can act intentionally to set aside judgments that lead to bias during the study (Peoples, 2021).

In this study, the observer kept a reflexive journal while collecting and analyzing data to monitor bias. The reflexive journal helps avoid influencing data (Smith & Luke, 2021). Adding entries to the reflexive journal continuously encouraged reflection on the current state of research and any shifts in views during data collection and analysis.

Assuring credibility can also be achieved through saturation by collecting all data necessary for a study, so there is no relevant information remaining to gather for analysis (Mwita, 2022). Saturation occurs when there is consistent repetition during the data collection or analysis process (Alam, 2021). Reviewing interview notes, transcriptions, and thematic codes for repetition occurred throughout this study.

Dependability

Dependability refers to the consistency of the findings (Peoples, 2021). In qualitative research studies, triangulation of data promotes dependability (Coleman, 2021). Triangulation involves collecting, analyzing, and comparing data using multiple techniques (da Silva Santos et al., 2020). Data triangulated were collected using questionnaires and interviews.

Another method used to support dependability was creating and maintaining an audit trail (Creswell & Poth, 2018). The audit trail included a detailed record of how data were collected and analyzed (Bloomberg & Volpe, 2019). Information on how the data supported the findings were also included in the audit trail (Carcary, 2020).

Transferability

Transferability, also known as generalizability, is established when sufficient information in the study is applicable in other contexts (Hays & McKibben, 2021). Readers should be able to develop a deeper understanding of the experiences of artificial intelligence in K–12 learning

environments based on the contextual elements of the study (Bloomberg & Volpe, 2019). Detailed descriptions derived from interviews, observations, and other data collection methods can meet the transferability requirements (Carminati, 2018). This study included rich and in-depth descriptions of the data collected from participants' questionnaires and interviews (Korstjens & Moser, 2018).

Trustworthiness

Trustworthiness is synonymous with confirmability and denotes findings are clearly connected to the data (Korstjens & Moser, 2018). Flynn and Korcuska (2018) identified member checking as an essential procedure in the phenomenological research process. Member checking involves sending participants their transcripts and summaries of their contributions for feedback and confirmation of the data (Thomas, 2017).

Participants received copies of the transcriptions from their interviews. After reviewing the transcriptions, participants confirmed the accuracy of the transcriptions or provided feedback with clarifying statements. Based on the feedback, the observer made corrections to the transcriptions. Through member checking, participants reviewed responses and verified the accuracy of the recorded data that reflected experiences with artificial intelligence applications in K–12 learning environments (Naidu & Prose, 2018).

Reducing bias is also a factor in establishing trustworthiness (Mackieson et al., 2019). Researchers can acknowledge understandings of bias and connect personal experiences that could influence interpretations and approaches to studies (Creswell & Poth, 2018). The reflexive journal entries written to support credibility and dependability also aided in reducing bias in this study (Peoples, 2021).

Ethical Procedures

Based on guidance from The Belmont Report (National Commission, 1978), researchers have three essential responsibilities to ensure the protection of research participants. An actionable component of the three responsibilities is obtaining approval from an Institutional Review Board (Dutka & Astroth, 2022). The American College of Education Institutional Review Board (IRB) granted approval of the study before formal research began (see Appendix C).

Respect for participants can be demonstrated by obtaining informed consent before collecting data (National Commission, 1978; Redman & Caplan, 2021). Informed consent is necessary, so participants are aware of the nature, goals, and any potential impacts of the study (Clayton et al., 2020). In this study, all potential participants received an informed consent document and acknowledged consent before proceeding with the questionnaire and interview (see Appendix G). There was a minimal chance for conflicts of interest because no participants worked with the observer.

Second, researchers can demonstrate beneficence by ensuring the confidentiality of participants is maintained by omitting identifiable information (Avant & Swetz, 2020). Any identifiable information such as names, birthdates, and school information were omitted during the data collection and analysis process. Questionnaires, digital notes, and digital transcriptions of interviews were secured on a password-protected Dell Inspiron P35E internal hard drive located in a home office. All data will be deleted from the hard drive within 3 years of the study's completion.

Third, researchers must demonstrate justice by ensuring participants are treated equitably (National Commission, 1978). Acting with intentionality helped avoid unfavorable selection criteria (Redman & Caplan, 2021). Bracketing and reflexive journaling were used to monitor bias (Peoples, 2021; Smith & Luke, 2021).

Chapter Summary

The methodology was qualitative because the study provided deep insights and understanding of K–12 teachers' lived experiences (Peoples, 2021). Since the study explored the lived experiences of K–12 teachers on the phenomenon of artificial intelligence applications in learning environments, the design was phenomenological (Stolz, 2020). Observation was the primary role of the researcher.

Fifteen participants were involved in the study, which was sufficient for a qualitative phenomenological study (Prosek & Gibson, 2021). Participants completed an online questionnaire and open-ended questions online or via interview. Validity and reliability were taken into consideration during data collection. Data were analyzed through coding, whereby the data were organized and sorted based on words or phrases representative of collected data (Bloomberg & Volpe, 2019; Saldaña, 2021).

Bracketing and a reflexive journal were employed to avoid bias and promote credibility (Barrett et al., 2020). To demonstrate dependability, data were triangulated, and there was an audit trail (Coleman, 2021; da Silva Santos et al., 2020). Descriptions regarding the lived experiences of participants included details that could be transferable to other contexts (Carminati, 2018). Member checking was used by the observer to support trustworthiness (Flynn & Korcuska, 2018). Ethical considerations were also taken into account throughout the study.

The following chapter will present data collection and analysis. Details about variability and reliability will be further explored. A thorough analysis of the data is an essential part of Chapter 4 and will inform the results of the qualitative case study.

Chapter 4: Research Findings and Data Analysis Results

As a result of the COVID-19 pandemic, the use of educational technology for student learning became necessary (Al-Rohaimi & Al Otaibi, 2020). Although there was widespread use of technology and related applications, gaps were also exposed in teacher training and capacity as well as access to crucial resources needed to support students (Al-Rohaimi & Al Otaibi, 2020). Emerging forms of educational technology powered by artificial intelligence (AI) began to surface in K–12 learning environments, but teachers did not know of their existence or lacked the capacity to effectively use AI tools (Oster et al., 2021).

The problem was K–12 teachers lacked sufficient experience and professional development opportunities to implement artificial intelligence in classroom environments effectively in the United States (Kim & Kim, 2022). The purpose of the study was to explore K–12 teachers' lived experiences with implementing or preparing to implement artificial intelligence and the professional development needed for implementation. This chapter details how data were collected from potential research participants. The processes used to analyze the data, including developing codes and themes, are explored. Data are examined as a response to the research questions related to the lived experiences of K–12 teachers implementing or planning to implement artificial intelligence in their learning environments. Explorations of reliability and validity provide a well-rounded overview to inform the basis for the study on AI and its impacts on K–12 education. The conclusion includes a summary of research findings and data analysis as well as an overview of the following chapter.

Data Collection

Potential participants responded to the recruitment communications beginning in January 2023 and ending in May 2023 by providing email addresses from their school districts or employer. Initially, informed consent was obtained by emailing the form to participants as an

attachment. After signing the form, participants would return the form via email communication. From January 9, 2023, through April 11, 2023, 15 potential participants provided email addresses and three of those individuals signed informed consent forms at a response rate of 20%.

For the remainder of April 2023 through the end of May 2023, the informed consent response rate was 100% when electronic signatures were obtained through an online Google Form. Emails were sent to respondents who completed the informed consent form but not the questionnaire or interview. Three never responded. Overall, 18 of 27 respondents provided informed consent and completed the questionnaire online for a response rate of 67%.

Once participants completed the questionnaire, they were sent a Calendly link to schedule an interview. Eleven interviews were scheduled through Calendly, and the interviews were started and completed at the allotted times. Four participants chose to complete the 10 open-ended questions through the online form. Although the first respondent provided their email address in January 2023, the first questionnaire and interview were not completed until April 2023. The final participant completed an interview on June 2, 2023.

The first deviation was a request to provide potential participants with the opportunity to sign informed consent and complete the questionnaire through an online Google Form. Requested changes made giving informed consent and completing the questionnaire more convenient for potential participants. There were also requested edits to the recruitment communication, adding ChatGPT to the language of the communication because of the AI application’s rapid expansion and association with artificial intelligence.

After the edited communication was posted, there was a request for a second deviation, so participants who provided informed consent online had the option to complete the 10 open-ended questions through a Google Form or to answer them during an interview via video

conferencing. The recruitment communication was not reposted; however, the option was added to the Google Form.

Data Analysis and Results

The data analysis spiral approach from Creswell and Poth (2018) was used to decipher the data. There are five steps in the data analysis spiral approach. The first step is managing and organizing the data, whereby researchers organize data into files and create a naming system to facilitate data retrieval (Creswell & Poth, 2018).

During collection, a unique identifier, which consisted of a letter and number combination, was assigned to each potential participant once email addresses were received. Digital folders were created and named using participant identifiers. After the demographic questions, interviews, and responses to open-ended questions were collected from participants, they were downloaded and stored on a password-protected hard drive.

Next, data were prepared by transcribing the interviews and transferring participant responses to a spreadsheet on the same hard drive. Demographic questions and interview questions were grouped separately and then sorted by participants planning to implement artificial intelligence applications and participants implementing artificial intelligence applications. Since open-ended questions were the same questions asked during interviews, the responses were sorted with interview questions. Transcripts were also uploaded to NVivo.

After the data were organized and sorted, reading and memoing emergent ideas in accordance with Creswell and Poth's (2018) data analysis spiral approach commenced. Transcripts, responses to open-ended questions, and the spreadsheet with participant responses were printed. Data were reviewed through each prompt to identify any emergent ideas. Different colors of highlighters and notetaking were used to emphasize any remarkable statements, recurring phrases, or comments in the transcripts and responses. Following the initial review,

transcripts and responses were read through again to identify additional recurring phrases or statements. Annotations were added to highlight emergent ideas and to further identify potential codes and themes.

When classifying codes into themes, the third step in the data analysis spiral approach, Creswell and Poth (2018) recommended generating an initial list of five or six codes, also known as lean coding. The initial codes were also tied to the research questions related to the lived experiences of participants implementing or preparing to implement artificial intelligence applications and related professional development. Change, recognition, engagement, assistance, technology, and economics, which form the acronym CREATE, were the six initial codes gleaned from the data. The acronym was used to classify codes further during the process.

Identifying expanded codes required additional reviews of data (Creswell & Poth, 2018). Transcribed data and responses were organized by question and reviewed again to apply expanded codes (see Table 1). Data were uploaded to NVivo to compare initial codes and expanded codes. The expanded codes were categorized to classify final codes, also known as subthemes, in accordance with the data analysis spiral approach.

Table 1

Example of Deriving Theme From Codes

Initial Code	Expanded Codes	Final Codes (or Subthemes)	Theme
Change	Promoting equity, Fear of cheating, Restricting access, New generation of students, Acceptable use policies, Embracing immersive experiences, Responding positively to teacher, Resistance to self-directed learning, Concerns about the future, Concerns about assignments, Attending trainings, Adding problem-solving	Concerns about change Getting ready for the future Opportunities to learn	Creating Opportunities using AI

Initial Code	Expanded Codes	Final Codes (or Subthemes)	Theme
	pedagogy, Creating instructional materials, Transition to facilitator role, District-supported professional development, Look for opportunities, Comes from leadership, Next big thing		

Six themes were derived from the final codes, which represented a reduction and further categorization of expanded codes (see Table 2). Following classification, developing and assessing interpretations is the next step of the data analysis spiral approach (Creswell & Poth, 2018). Interpretation involves making sense of the data through the lens of themes (Creswell & Poth, 2018).

Table 2

Themes

Derived Themes
Theme 1: Creating opportunities using AI
Theme 2: Acknowledging impact of AI
Theme 3: Engaging every learner through AI
Theme 4: Alleviating time constraints with AI
Theme 5: AI-powered technology as a tool
Theme 6: Funding AI is necessary

Theme 1: Creating Opportunities Using AI

For many participants, creating opportunities using AI represents a shift forward from existing modes and methods of teaching. An example of the shift was shared by participant A26, “It's changed my teaching style to where I could be more of a facilitator instead of making them sitting there listening to me lecture.” Shifting forward is related to building personal knowledge

of AI while creating opportunities for learners to experience AI in classroom learning environments.

Learning more about AI through trainings and professional development was identified by participants as ways to shift forward by building personal knowledge. Professional development that is meaningful with specific examples of how to use AI in the classroom was among the popular sentiments shared by participants. Webinars, district in-service, in-person trainings, and conferences were cited by participants as examples of professional development opportunities. One significant revelation from some participants was the preference of learning about AI through colleagues who had prior experiences.

Participants' reasons for increasing their knowledge about AI centered on their desire to create opportunities for students. One significant finding from the data was the idea of promoting equity by providing access to learning about AI. Statements supporting equity through access include a comment from Participant 18, who expressed hope that AI "could help [students] be on a more equitable playing field." The effect of access through equity extends to future prospects for students, as evidenced by participants' wonderings about students' ability to earn money or have successful careers without sufficient knowledge of AI.

Properly preparing students for an AI-powered world requires incorporating AI in lessons and assignments. Participants stated that the availability of AI helped in several ways, including making suggestions for plans, creating plans based on prompts, and using AI tools and applications during lesson implementation. As cited by several participants, the ability of programs such as ChapGPT to generate lesson plans and activities creates opportunities for students to learn about AI.

Theme 2: Acknowledging Impact of AI

The emergence of ChatGPT was an entry point to AI for several participants, and the impact of AI in classroom learning environments was described as transformative. There was a collective awareness of the current position of AI in society as evidenced by a statement from Participant A23, “AI is an integrated tool that students and teachers both use in their daily life.” Additional participants expressed similar sentiments, describing how AI is infused into social media, finance, mobile applications, and other parts of society. As AI becomes more prevalent, findings support the notion that the impact on students and teachers will increase.

Given the proliferation of AI inside and outside the classroom, some participants recognized the necessity of gaining a basic understanding of AI, including Participant A19: “It is time for us to know what’s the next step because at some point in time, this is coming.” If teachers are not knowledgeable about AI at a minimal level, guiding students in exploring AI in classroom learning environments will be challenging for them.

The realization that teachers could be responsible for helping students navigate AI will propel teachers to learn more about AI. The acknowledgment of addressing the learning necessary is described by Participant A5:

> I think with professional development, it has to be framed in a way just like when we were teaching students digital citizenship and how to use the internet responsibly. That same line needs to be hit with using AI in the classroom because it isn't going to go away.

When considering participant statements, teachers’ efforts to gain a deeper understanding of AI could mirror previous steps taken to support students exploring digital tools.

Theme 3: Engaging Every Learner Through AI

Reaching every learner will require establishing multiple learning pathways with AI that promote engagement. Artificial intelligence was positioned as a resource that could help participants reach more students. When discussing how AI was incorporated into a virtual

classroom learning environment, A26 recounted the excitement of using AI to meet students' needs: "[We] develop an individualized action plan if [students are] off in their performance." Sentiments of excitement and even a sense of gratefulness were expressed by other participants when describing interventions and personalizing lessons, especially when students were struggling to learn concepts.

Nine of the fifteen participants had descriptions related to engagement, including competition through gameplay, station rotations, conversations with students, and technology integration with specifically named AI-powered tools. Learning pathways described by participants allude to experiences that will allow students to interact more with learning resources and with each other. When describing a lesson on coding a machine to choose between marine life and plastic waste, Participant A24 noted, "[Students] were excited to really excited to learn that they could program a machine really to recognize those types of differences." Other participants noted similar enthusiasm from students through interactions, which will lead to increased engagement and a deeper understanding of concepts.

Peer collaboration is another step used to increase student engagement, as cited by Participant A20: "[A]nything that is tactile that they can do that they can get into small groups, they can have discussions and they could, you know, help one another." When students collaborate, some participants transition into the role of facilitator while other participants use collaboration time to work individually with students on an as-needed basis. Based on the findings, teachers implementing AI in classroom learning environments can expect similar opportunities to facilitate learning or to work closely with students.

Participant A6 revealed that the emergence of AI "has reaffirmed within myself my commitment to more of a problem-posing type of pedagogy." Problem-solving and project-based learning were cited by multiple participants when describing their eagerness to engage students

with AI as a means of promoting critical thinking skills needed for the future workforce. Through participant descriptions, problem-solving units could include coding with robots, using AI in response to a societal issue, and developing student-customized projects. According to participants, students were more engaged when they could design or choose their learning experiences than when participants directed lessons.

According to four participants, artificial intelligence will help teachers further support students will special needs. Participant A19 explained how AI tools could help, "especially for routine tasks dealing with students on a [autism] spectrum. Everything is routine for them. So that would be something that will keep them engaged." Based on the misgivings participants expressed about current instructional plans available to serve students with special needs, their routines, accommodations, or other interventions could be better detailed when using tools such as generative AI to outline individualized education plans or multi-tiered systems of support.

Theme 4: Alleviating Time Constraints With AI

By alleviating time constraints, teachers can maximize opportunities for learners. Artificial intelligence was mentioned as a time-saver numerous times by multiple participants. Tools such as the generative AI chatbot, ChapGPT, enabled Participant A20 "to take loads off of my professional plate with regards to optimizing my time with the things I want to get done, things I was to accomplish as relates to my pedagogy." Nine of fifteen participants mentioned time as a factor in connection with AI, with several attributing saving time to AI-powered tools because they were easy to use. Based on participants' statements, the ease of use and the prospect of saving time could factor into the proliferation of AI in K–12 learning environments.

According to participants, the time-saving aspects of AI positively impacted their lesson planning. "Straight to the point, I mean, it's more opportunities to plan more in less time, but also in my creation of higher quality materials," offered Participant A21. As participants

indicated, the lessons created were not only higher quality but also more interactive, which leads to increased engagement.

In addition to more planning time, participants discussed how they were able to automate tasks such as grading assignments and provide instant feedback with AI. When describing how assignments are graded, Participant A5 explained:

> When [students are] turning in written work, we have that check my work link where it checks for plagiarism. And then now I'm trying to find the AI writing check resource and the copy leaks to see if there's a chance that it was AI-generated. I'm taking it as like a point of conversation for those students.

The example shared by participants such as A5 supports two findings: (a) when students receive feedback faster, they can make necessary adjustments to increase their understanding of a concept, and (b) with the release of ChatGPT, the need to evaluate student work faster will intensify as districts navigate student use of generative AI.

Faster and better communications with stakeholders, including colleagues, families, and the community, is another finding revealed by reviewing participant data. Participant A21 described how generative AI assists with communications:

> I've been known to be very direct with regards to what my expectations were, or issues. I found with ChatGPT, I can put all my thoughts into a potential email format that I want to use to express or convey a message. I kind of get a more customer service-like tone.

Improved communication, such as presented by Participant A21, could lead to stronger relationships inside and outside of the school building.

Theme 5: AI-Powered Technology as a Tool

The theme of technology as a tool represents how teachers can use AI-powered technology to facilitate and enhance learning about AI in a variety of contexts. When considering

how to view technology and AI, Participant A18 stated, “Technology is supposed to be viewed as an assistant to your teaching.” Participants were optimistic about the potential of AI as classroom aides or co-teachers, and based on the number of specifically named tools, including ChatGPT, Curipod, Canva, Codebreaker Byte, Google Classroom, and Seesaw, AI-powered technology could be pervasive in learning environments.

In addition to assisting teachers, findings showed that AI-powered tools can evaluate, strengthen, or reinforce what was taught. Participant A18 discussed how AI was used to support a lesson on literacy devices and provided students exit tickets to gauge understanding. “They actually got it. We really took everything from the AI we could and put it in those lessons and that station rotation. It worked beautifully.” Using AI as a tool for assessment was mentioned by four of seven participants currently implementing AI in their classrooms, which supported the finding that evaluation will be a critical component as AI usage expands.

Relying on AI-powered technology as a tool is not limited to the classroom learning environment. As indicated by participants viewpoints about how they gained knowledge about AI, social media beyond the classroom can be a tool for learning about AI. This sentiment was shared by Participant A24, “Twitter has been helpful in finding the newest AI apps and resources, as there are new ones coming out daily.” The influence of social media for learning may appeal to more than adults, and according to one participant, TikTok is one tool students could use to gather more information on AI.

Non-confirming data were represented by participants who were planning to implement AI in their classrooms but were unable to use AI-powered tools due to access issues. Participant A24, who experienced using AI in a limited capacity, shared, “Currently, AI applications are blocked by the district, so there is not an opportunity for integration on school devices.”

Participants cautioned against barriers to access such as banning generative AI or blocking AI applications because restrictions could have a chilling effect on students long-term.

Theme 6: Funding AI Is Necessary

Economic disparity was on the minds of multiple participants, particularly when discussing student populations and access to AI. Several participants mentioned that their students were economically disadvantaged or attended Title I schools. When considering the connection between finances and access to AI, Participant A20 stated, “I feel like districts need to have access to more funding to offer these programs.” This statement signifies that a lack of funding may be a barrier to accessing AI-powered tools, which could create a society of AI haves and have nots. To combat the access challenge, findings show that teachers may seek funding from sources other than their school districts, as indicated by participants who stated that they planned to seek grants to finance their AI-related programs.

Concerns about funding insecurity extend to professional development needed to integrate AI into classroom learning environments. A significant statement from Participant A20 confirms funding concerns: “How much money we have will determine how much access that we have to these type of programs.” Many teachers rely on their districts or regional service centers for professional development. Participant statements show that teachers may not be able to afford professional development outside of their districts or regions. Therefore, educational institutions must plan to invest in AI-related professional development to support teachers incorporating AI into their classrooms.

Addressing Research Questions

The results from the collected data addressed the first research question related to teachers’ lived experiences with implementing artificial intelligence applications in K–12 learning environments in the United States. Participants used various readily available AI-

powered tools, including ChatGPT, Google Classroom, Google Docs, and Perplexity, for generating ideas and enhancing instruction. The tools helped participants save time completing certain tasks, including grading assignments, lesson planning, and drafting communications for families, so they had more time to support students.

Using AI-powered tools increased student engagement, particularly when students were able to interact with tools during lesson implementation. Notable competitiveness among peers was observed when using AI for classroom gameplay. Students were only hesitant to use AI when they were unfamiliar with the technology or when they needed assistance.

Another development of using AI was shifting forward with regard to teaching styles. Participants acted more as facilitators in classroom learning environments where AI was implemented. There was also an increase in problem-solving strategies and hands-on activities. To stay up-to-date with AI in education, participants used a variety of means, including social media, organizations, conferences, and colleagues.

The findings also addressed the second research question regarding teachers' lived experiences with professional development opportunities related to implementing artificial intelligence applications in K–12 learning environments in the United States. When describing experiences, participants cited a lack of professional development opportunities. While there was some reliance on districts or educational service centers to provide professional development, efforts to obtain professional development were mostly self-initiated through organizations. The release of ChatGPT increased interest in obtaining professional development on AI so that participants could learn about time-saving tools and guide students. Participants also depended on colleagues who had experience with AI to gain knowledge on implementing AI in learning environments. Funding issues and geographic locations were barriers to accessing professional development related to AI.

Reliability and Validity

Maintaining credibility and dependability throughout the study was of upmost importance (Bloomberg & Volpe, 2019). Multiple strategies were used during data collection and analysis, such as member checking and triangulation, to ensure credibility and dependability and to promote transferability. To minimize bias, several actions including the use of a reflective journal were implemented to bolster trustworthiness.

Credibility

There were several actions taken to establish credibility. Subject matter experts reviewed demographic and open-ended questions and provided feedback. Adjustments were made to the instruments based on feedback before they were used for data collection.

To avoid inserting personal bias or beliefs into the collected data, bracketing was used by maintaining a reflexive journal throughout the study. Entries were consistently added to the journal to reflect on the research process. During interviews and while reviewing data, bracketing involved taking notes in the journal to monitor bias and to avoid influencing data.

To achieve data saturation, transcripts and responses to open-ended questions were reviewed repeatedly. Data from transcripts were checked for repetition. Data continued to be examined until there were no additional details available for analysis.

Member checking was also incorporated to promote credibility. Following participant interviews, responses were transcribed and emailed to participants along with a message to review the transcripts to ensure what was transcribed reflected the participants' interviews. Replies from participants affirmed the transcripts were accurate representations of their responses.

Dependability

To establish dependability of the findings, data triangulation was used. Multiple data sources, including transcripts, interviews, and questionnaires, were compared during analysis. Another action taken for dependability was creating an audit trail. Details on how data were collected, including dates and tools used, were included in the audit trail. Connections between the data and the findings were incorporated into the audit trail.

Transferability

The study included rich and thorough descriptions of participants' responses collected from the questionnaires. Interviews were another source for gathering in-depth data. The findings are supported by detailed descriptions, which include exact quotes and paraphrased comments from participants.

Trustworthiness

Consistent and continual use of the reflective journal helped monitor and identify any instances of bias. The journal included notes of personal experiences, wonderings, understandings, and other pertinent information. Notes were reviewed and updated on a regular basis with the goal of reducing bias that could influence the study.

Chapter Summary

There were two research questions in the study. Findings from data collected addressed Research Question 1: What are teachers' lived experiences with implementing artificial intelligence applications in K–12 learning environments in the United States? Participants indicated that they were using multiple tools powered by artificial intelligence (AI) in their classroom learning environments. The availability of AI-powered tools has given participants more time to plan lessons, generate ideas, provide feedback, grade work, and interact with students. As a result, there was increased student engagement through activities such as gameplay and immersive interactive experiences. Negative reactions from students were minimal

and generally manifested when students lacked understanding. Overall, teachers have embraced the idea that AI is here to stay and want to ensure students are prepared for an AI-driven future.

Results from the data collected addressed Research Question 2: What are teachers' lived experiences with professional development opportunities related to implementing artificial intelligence applications in K–12 learning environments in the United States? Participants were not exposed to many professional development opportunities, and their efforts to learn more about AI were typically self-initiated. There was an expressed desire to learn more, with many participants seeking more district or regional service center offerings.

Colleagues were a source of learning more about AI for participants. In-person conferences and online professional development such as webinars and videos were popular choices among participants. Despite the availability of options mentioned in the previous sentence, geographic and financial barriers prevented some participants from attending. Recent developments, such as the release of ChatGPT, should increase professional development opportunities related to AI.

Key findings from data collection and analysis will be discussed in Chapter 5. Findings, interpretations, and conclusions will be explored. Limitations will be described, and recommendations for leadership will be presented. The conclusion of the chapter will include reflections, summaries, and critical outcomes of the study.

Chapter 5: Discussion and Conclusions

The global pandemic caused by COVID-19 and the resulting aftermath revealed the need for educational technology in K–12 learning environments and exposed the gap in resources and technology-focused teacher professional development. An increasing number of tools and applications powered by artificial intelligence emerged; however, teachers did not know of their availability or lacked the experience and training necessary to effectively use AI in learning environments. The purpose of the study was to explore K–12 teachers' lived experiences with implementing or preparing to implement artificial intelligence and the professional development needed for implementation.

Research questions for the study addressed the lived experiences of participants related to implementing artificial intelligence applications in learning environments and professional development opportunities. Participants responded to questionnaires through Google Forms and answered open-ended questions online or during interviews via video conferencing. Responses to demographic and open-ended questions indicated that participants were willing to share lived experiences and provide their perceptions of AI and professional development in K–12 learning environments.

As shown in Table 2 in the previous chapter, six themes emerged from collected data, ranging from creating opportunities with AI to funding AI is necessary. Findings revealed that participants experienced fewer time constraints when implementing AI tools and applications. For school districts seeking guidance on selecting relevant AI tools, understanding how teachers use AI could impact investment. Companies developing AI-powered resources could also benefit from knowing which features of AI make tools attractive to teachers.

Participants also experienced increases in student engagement when incorporating AI-powered tools in learning environments. Students were particularly engaged when they used the

tools as part of their learning. The level of engagement was a factor participants noted when discussing changes in their teaching styles. Similar to participants, teachers who decide to implement AI may alter teaching styles by taking on the role of facilitators or by planning project-based learning into lesson cycles.

When discussing lived experiences related to professional development opportunities focused on artificial intelligence in education, participants indicated there were minimal options available. Participants often sought out AI-related professional development on their own because school districts and regional education service centers had no available offerings. Geographic and economic barriers prevented some participants from in-person professional development opportunities, leaving social media as a primary source of information.

The following sections of Chapter 5 detail reflections on findings from the study. Findings are compared with existing peer-reviewed literature and addressed as confirmed, disconfirmed, or extending knowledge in the discipline. Meanings derived from findings are clarified by analyzing and interpreting data in the context of the theoretical framework of constructivism and the concerns-based adoption model. Within the scope of the study, interpretations, inferences, and essential conclusions are presented while avoiding bias.

Limitations of the study, with a particular emphasis on transferability, are addressed along with credibility, dependability, and confirmability. The extent to which the results can be applied to other situations with different populations are explained. Recommendations are presented based on findings and data analysis from Chapter 4 through the lens of a global perspective. Further recommendations for additional research are grounded in the study.

Recommended changes in policy and practices for practitioners and policymakers are supported by results. Implications for leadership are described through potential impact at appropriate levels. Possible actions that could be implemented are identified and described. The

conclusion includes highlights from the findings, reflections on new knowledge, and summaries of implications and critical outcomes.

Findings, Interpretations, and Conclusions

Artificial intelligence (AI) has been part of education since the 1960s, but the increasing influence of AI in K-12 learning environments is more recent (du Boulay, 2019; Humble & Mozelius, 2022; U.S. Department of Education, 2023). Findings confirmed that many participants had recently learned of artificial intelligence on a cursory level, particularly after OpenAI released the generative AI tool ChatGPT. A review of studies related to AI in education revealed that applications of AI for educational use include chatbots, robots, adaptive assessments, personalized learning, teacher support applications, and intelligent tutoring systems (Popenici & Kerr, 2017; Salas, 2020; Walsh, 2018). Some participants also indicated using similar tools, in addition to generative AI, in the current study.

Despite the proliferation of AI-powered tools and resources, teachers are still inadequately prepared to use AI effectively in classroom environments (Oster et al., 2021). Results of the study confirmed that there is some access to AI applications; however, there is a disconnect between the training necessary to commence or expand classroom implementation and available professional development. Findings are aligned with results from the literature reviewed in Chapter 2 indicating a lack of professional development opportunities for teachers seeking to implement AI in learning environments (Marrhich et al., 2021; Murphy, 2019; Wang et al., 2021).

Additional confirmation stems from participants noting a lack of offerings at district and regional levels. Results extended the knowledge in the literature to reveal social media as an option to gain skills on implementing AI with the emergence of generative AI serving as a catalyst. Participants also listed colleagues and coworkers as sources of information to increase

comprehension. Other extensions of knowledge in the literature arise from financial and geographic barriers that prevented many participants from receiving in-person professional development related to AI.

Findings can be interpreted to conclude that participants who implemented AI in classroom learning environments experienced more student engagement than when AI was not implemented. Therefore, teachers and other educational stakeholders can infer that student engagement will increase if artificial intelligence is implemented in classroom learning environments. Participants experiencing fewer time constraints when using AI tools and resources to complete tasks is another conclusion that can be interpreted from the study's findings. Consequently, teachers and other educational stakeholders can infer teachers would experience fewer time constraints when using AI tools and resources when completing similar tasks.

Another possible interpretation based on the findings is that participants have minimal professional development opportunities, particularly in school districts or regional service centers where they serve as teachers. School district leaders could infer that investing in professional development focused on AI is necessary for teachers to gain requisite knowledge. Additionally, findings can be interpreted to conclude that there were geographic and financial barriers to available professional development opportunities, reinforcing the inference that local, district-sponsored professional development is needed.

As noted in Chapter 2, Generation Alpha includes children born during or after 2010. Children born in 2010 should reach their 13th birthday in 2023 and would be entering the seventh or eighth grade in most traditional schools in the United States. Demographic data from the study showed that 12 of 15 participants taught grades kindergarten through eighth grade; therefore, an inference can be made that most participants teach children of Generation Alpha.

Additionally, participants who teach students in Grades 9-12 will begin serving Generation Alpha during the following school year. Teachers preparing to teach in a world heavily influenced by AI can receive training on the idiosyncrasies of Generation Alpha, including how children interact with technology.

Theoretical Framework

Study results revealed participants' experiences with technology contributed to their desire to learn more about artificial intelligence, which aligns with Piaget's constructivist contention that prior knowledge relates to the acquisition of new knowledge. Findings also showed that participants with a high level of technology integration experience are more likely to implement artificial intelligence in learning environments than participants with moderate to some levels of technology integration, reinforcing the impact of prior knowledge and the connection to knowledge acquisition. To enhance connections to AI based on the constructivist notion of learning through prior experiences, teachers would benefit from professional development offerings that include examples of how AI is currently used in classroom learning environments. Examples of how AI is already transforming education could be used in professional development to activate prior knowledge, thereby supporting the viewpoint that teachers will accommodate new knowledge about AI to transform their learning environments.

Findings reinforced Vygotsky's contention that social interaction was part of learning acquisition because engagement among students and teachers was higher when they collaborated with others while learning about AI or planning to implement AI in learning environments. Social interaction promotes engagement, and results showed engagement was a key component of lesson planning and implementation. Students were more engaged when they were actively involved in learning about AI or using AI-powered tools and resources such as coding and robots.

Placing an emphasis on collaboration through interaction based on Vygotsky's social constructivist theory contrasted with literature reviewed in Chapter 2 indicating that AI could promote personalized learning because meeting the unique needs of students requires learning environments designed for the individual learner (Tang et al., 2019). These results showed that balancing students' needs with social aspects of learning will be an important consideration during the planning and implementation stages of school and district AI integration.

Although stages of concern data are traditionally collected and analyzed through a questionnaire, other methods of interpreting stages of concern (SoC) data obtained by interviews are to align themes with SoC levels or to map strategies with concerns-based adoption model (CBAM) framework (Haines, 2018; Min, 2017). Results connected to participants who were planning to implement AI align with the informational stage of concern, which signify interest in AI and wanting to learn more about the technology. Other participants planning to use AI or serving in districts that had restricted AI usage indicated using ChapGPT as a time-saving tool and expressed wonderings about how they would use AI in their classrooms. The personal stage of SoC relates to teachers who are more concerned with how technology will impact them when implemented (Min, 2017). Concerns about student experiences manifested from participants who were implementing AI and fit within the task section of the SoC of the CBAM framework, which include the stages of management and consequences. The former stage connected with participant data regarding lesson implementation whereas the latter stage aligned with results about student engagement.

Scope of the Study

The scope of the study outlined the parameters for addressing the research questions, the population targeted for the study, and the time in which the study was conducted. Teachers who were currently serving as K–12 teachers and who were implementing or planning to implement

AI in classroom learning environments were the target population and were recruited through social media websites and a private Facebook group. Fifteen teachers comprised the study sample, and the study was conducted between January 2023 and June 2023.

Since the study focused on the lived experiences of K–12 teachers regarding AI in education, a qualitative phenomenology was selected. There were two research questions guiding the study. The first question focused on the lived experiences of K–12 teachers with implementing AI in classroom learning environments. Lived experiences of K–12 teachers related to AI professional development opportunities were the focus of the second question. Participants experienced increases in student engagement and time for completing teacher-related tasks when implementing AI in their classroom learning environments. Despite increases in engagement and decreases in time commitment, participants also experienced a lack of professional development opportunities or financial and geographic barriers to accessing professional development opportunities.

The most important conclusions from the study included the increases in student engagement due to the implementation of AI and the time saved on traditional teacher tasks such as grading assignments by using AI-powered resources and tools. Likewise, additional significant conclusions centered on the lack of local or district-provided professional development opportunities on AI implementation for K–12 teachers and the geographic and financial barriers that impact access to relevant professional development. Noted revelations from the research included participants relying on colleagues as sources for learning about AI and the use of ChapGPT as an entry point for experience using AI as a tool. Only data collected from participants were used to draw conclusions to avoid the influence of personal knowledge and opinions; therefore, the interpretations, findings, and conclusions did not exceed the scope of the study.

Limitations

Throughout a phenomenological study, there is the potential for influences beyond the researcher's control that can impact the transferability and credibility of findings (Peoples, 2021). Only 15 of 27 people who responded to the initial recruitment communication were interviewed, which could limit transferability when applying findings to varying contexts. Therefore, in-depth interviews with open-ended questions were used to gather rich, detailed descriptions of participants' lived experiences (Semyonov-Tal & Lewin-Epstein, 2021).

Since bias can also limit transferability, a reflexive journal was maintained during the study (Hays & McKibben, 2021). Detailed personal descriptions were recorded in the journal as part of the monitoring process. Proper utilization of the reflexive journal ensured that just data collected from participants informed the findings of the study. Bracketing was used through the creation and maintenance of the reflexive journal as well. Through a systematic approach of reflection and checking for bias, confirmability was realized.

Recommendations

Lack of knowledge about AI and its potential applications in learning environments can lead to mistrust and promote misconceptions, slowing the adoption of AI in K–12 education (Nazaretsky et al., 2022). Professional development is not only needed to increase teacher awareness but also to aid instructional design and creation of AI-related curriculum on a global scale (Lin et al., 2022). Decision-makers for school districts and other educational institutions should invest in professional development that provides a detailed overview of AI and how the technology can be applied in different educational contexts. Teachers should also have time to explore emerging AI tools and resources through pilot programs or as part of a school or district-supported initiative. As teachers become more familiar with AI technology, additional learning

opportunities should be provided to promote the creation of activities, lessons, and units where AI is the focus of the lesson or incorporated into tools students use to master concepts.

District decision-makers should also consider the implications of restricting access to AI. In cities like Seattle, New York, and Los Angeles, initial reasons for district restrictions of AI-powered programs such as ChatGPT include cheating and plagiarism (Halaweh, 2023). Beyond the headlines, there were additional causes for restricting AI usage, including ethics and privacy concerns (Halaweh, 2023). Given the legal requirements designed to protect students' privacy rights in the United States such as FERPA and the Children's Online Privacy Protection Act (COPPA), districts and educational institutions should ensure ethics and AI literacy are included in learning opportunities for educators and students as opposed to restricting access. Educational stakeholders residing in other countries should also consider AI ethics and literacy for student and teacher training.

Since there were only 15 participants in the study, increasing the sample size for future research should be significant to the field of AI in K–12 education. As evidenced by the reactions to ChapGPT and limited professional development opportunities, further research should deepen understanding of the impact of AI in education. Many AI tools designed for use in education are new, and research regarding the effectiveness of these tools, particularly with student outcomes, should be beneficial to educational stakeholders seeking to make decisions regarding investment or implementation.

Implications for Leadership

Society has entered the Fourth Industrial Age, which is dominated by automation and artificial intelligence (Caudill, 2020; Jung, 2020; Moloi & Mhlanga, 2021). As educators at all levels grapple with how to prepare students for a technology-driven future, there is potential for positive change if decision-makers appropriately invest in curriculum, AI tools and resources,

and professional development that helps reach and teach all students. Individuals exposed to AI will be better positioned to navigate AI in schools and the workplace. Families will be able to better support students if leaders are intentional about providing communications about AI through meaningful channels such as public-facing events. The unique needs of students currently attending K–12 institutions, including Generation Alpha, must also be considered. Keeping teachers in the loop may bolster the success of AI implementation. Teachers can be part of the decision-making and planning processes of school or district AI initiatives.

Educational leaders must also become knowledgeable about AI as they consider policy changes that provide guidance in areas such as ethics, privacy, and data sharing. Since many educational institutions already work with educational technology companies and providers, leaders can review current contracts, license agreements, data-sharing agreements, and memorandums of understanding to make adjustments as necessary. Protecting student data is a top priority; therefore, systems need to be in place to comply with FERPA, COPPA, and other federal, state, and local laws and regulations in the United States. Educational leaders in other countries should comply with laws and regulations applicable to their respective locales.

Teachers rely on their districts to provide curriculum and professional development. Additionally, there is a high level of interest in implementing AI or expanding AI usage in schools. School and district leaders are in an excellent position to leverage expectations and positive sentiments into actionable steps toward widescale AI implementation. The end result could be a highly functioning, inclusive society where humans and technology interact for the greater good.

Conclusion

The study explored the phenomenon of artificial intelligence implementation in K–12 classroom learning environments. A review of existing literature revealed that artificial

intelligence in education was not new. Although AI was more prevalent in higher education, there were some instances where AI was used in K–12 schools. Findings confirmed that implementation and professional development opportunities at K–12 school districts in the United States were limited.

Participants who were implementing AI in their classroom learning environments detailed positive experiences such as increased student engagement and motivation. Results from the study confirmed literature indicating that AI could be used to support teachers, particularly with completing administrative tasks (Marrhich et al., 2021; Popenici & Kerr, 2017). Minimizing time for actions such as grading and lesson planning could maximize time for working with students and developing essential relationships.

New knowledge from the study includes the rapid expansion of AI in education due to ChatGPT. Researchers had studied the effectiveness of chatbots in education; however, ChatGPT served as an introduction to AI for many educators, including participants in the study. As AI becomes more prevalent, districts and other educational institutions should address how teachers and students will access AI within school systems. Leaders can consider the ethical and operational implications of increased AI usage with changes in policy and codes of conduct as well as investment in professional development, appropriate resources, and security infrastructure.

Facing the future of AI will not come without challenges. Equity and funding concerns are potential barriers to access and opportunity. Teachers and students will need to learn additional skills to navigate AI properly. Leaders should act with intentionality to prevent a world with AI haves and have-nots, where some students are prepared for the Fourth Industrial Age and others lack the ability to succeed in higher education or the workplace. Educational

stakeholders can meet these challenges and ensure students in Generation Alpha and beyond are future ready.

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Appendix A:

American Institutes of Research Copyright Request

Your AIR Copyright Request Was Received

AIR Copyright Request [redacted]
Sat 8/19/2023 8:33 PM

[redacted]

[You don't often get email from [redacted] Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

Please be cautious
This email originated from outside of ACE organization

You submitted the following data using the AIR "Copyright Request Form" page at:
https://nam11.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.sedl.org%2Fabout%2Fcopyright_request.html&data=05%7C01%7Cnneka.mcgee2234%40my.ace.edu%7Cd6cafe0e731b4b92f2f508dba11d701e%7C9a7b4189e70043cdb7e3283d6037c350%7C0%7C0%7C638280920044615914%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=wHVghNzv6EWkIOqS52B2J1xN8pqW1k%2BSOnMsBS7LrbM%3D&reserved=0

This is a courtesy copy of the information you submitted.

[redacted]

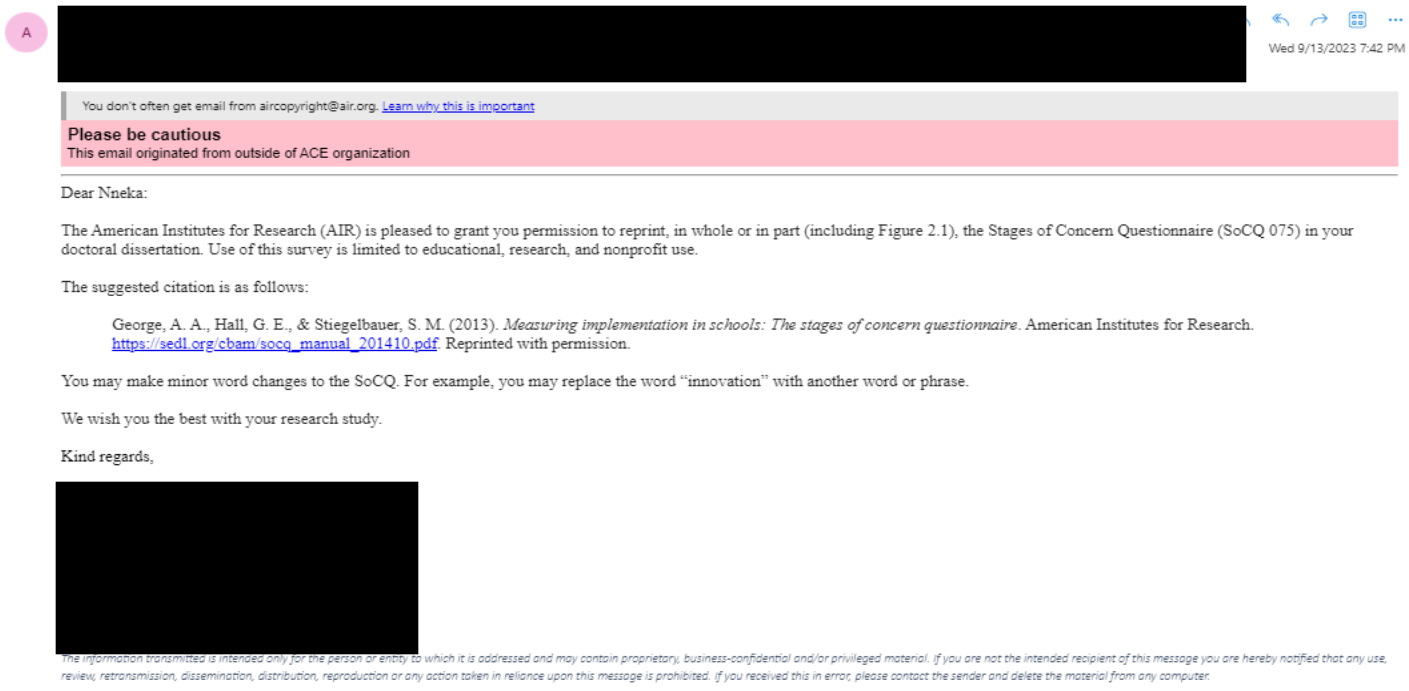
Send form to = me

DESCRIPTION OF THE SEDL MATERIAL:

Title = Figure 2.1 The Stages of Concern about an Innovation
Source = Measuring implementation in schools: The stages of concerns questionnaire
URL =
Pages = 8
Authors = A. A. George, G. E. Hall, & S. M. Stiegelbauer
Pub Date = 2006/2013
Full-text or Excerpt = Full-text

Appendix B:

American Institutes of Research Copyright Permission



A [redacted] Wed 9/13/2023 7:42 PM

You don't often get email from aircopyright@air.org. Learn why this is important

Please be cautious
This email originated from outside of ACE organization

Dear Nneka:

The American Institutes for Research (AIR) is pleased to grant you permission to reprint, in whole or in part (including Figure 2.1), the Stages of Concern Questionnaire (SoCQ 075) in your doctoral dissertation. Use of this survey is limited to educational, research, and nonprofit use.

The suggested citation is as follows:

> George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2013). *Measuring implementation in schools: The stages of concern questionnaire*. American Institutes for Research. https://sedl.org/cbam/socq_manual_201410.pdf. Reprinted with permission.

You may make minor word changes to the SoCQ. For example, you may replace the word "innovation" with another word or phrase.

We wish you the best with your research study.

Kind regards,

[redacted]

Appendix C:

American College of Education Institutional Review Board Approval

December 14, 2022

[redacted]

From : Institutional Review Board
American College of Education

Re: IRB Approval

"Artificial Intelligence and Teachersâ€™ Perceptions of its Impact on Educating Generation Alpha in Kâ€“12 Schools in the United States: A Qualitative Phenomenological Study"

The American College of Education IRB has reviewed your application, proposal, and any related materials. We have determined that your research provides sufficient protection of human subjects.

Your research is therefore approved to proceed. The expiration date for this IRB approval is one year from the date of review completion, December 14, 2023. If you would like to continue your research beyond this point, including data collection and/or analysis of private data, you must submit a renewal request to the IRB.

Candidates are prohibited from collecting data or interacting with participants if they are not actively enrolled in a dissertation sequence course (RES6521, RES6531, RES6541, RES6551, RES6561, RES6302) and under the supervision of their dissertation chair.

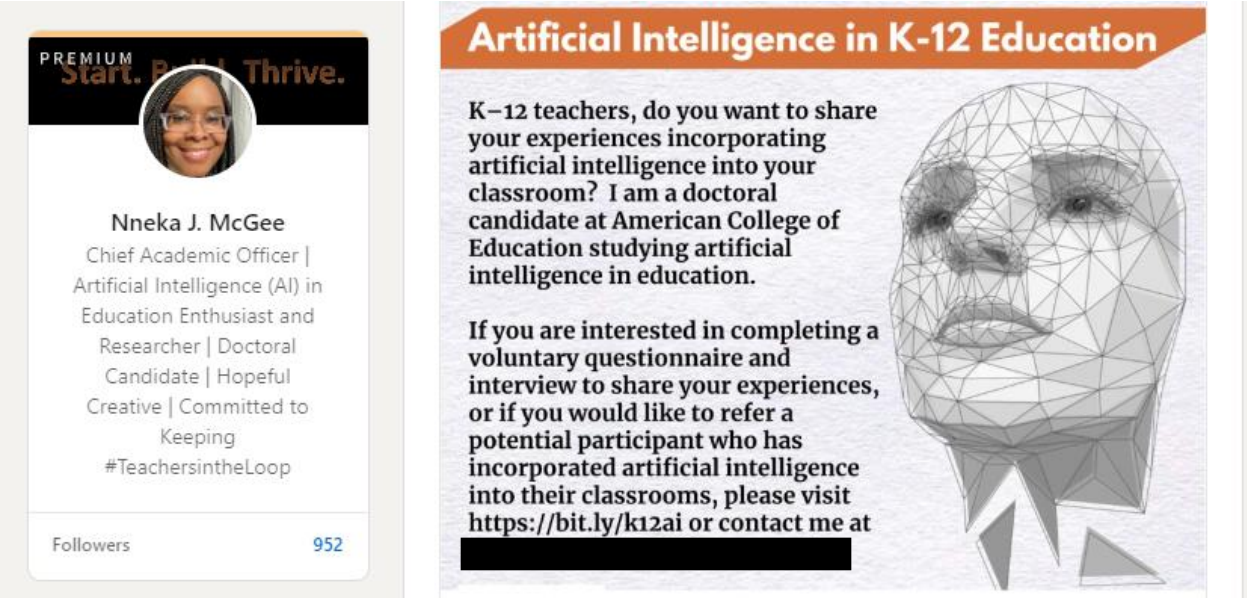
Our best to you as you continue your studies.

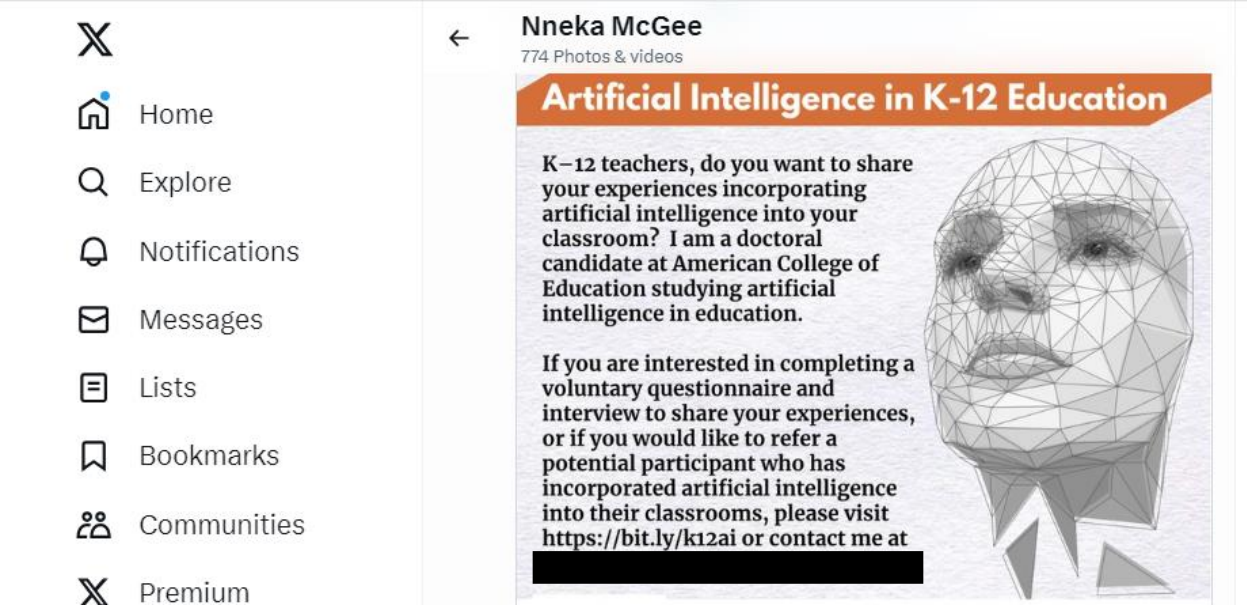
Sincerely,

[redacted]

Appendix D:

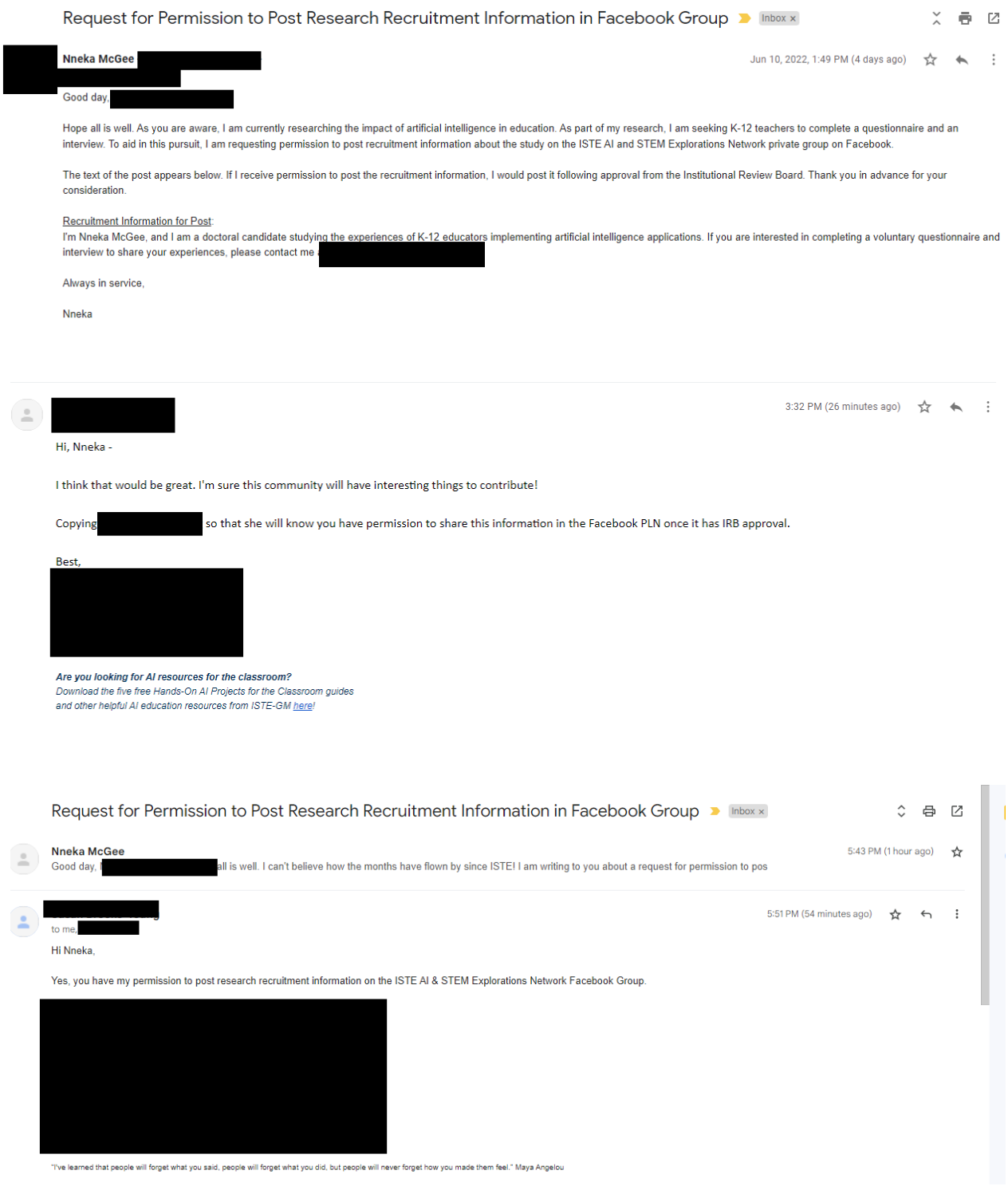
Social Media Post from LinkedIn and X (formerly Twitter)





Appendix E:

Private Facebook Group Site Permission



Request for Permission to Post Research Recruitment Information in Facebook Group Inbox ×

Nneka McGee [redacted] Jun 10, 2022, 1:49 PM (4 days ago)

Good day, [redacted]

Hope all is well. As you are aware, I am currently researching the impact of artificial intelligence in education. As part of my research, I am seeking K-12 teachers to complete a questionnaire and an interview. To aid in this pursuit, I am requesting permission to post recruitment information about the study on the ISTE AI and STEM Explorations Network private group on Facebook.

The text of the post appears below. If I receive permission to post the recruitment information, I would post it following approval from the Institutional Review Board. Thank you in advance for your consideration.

Recruitment Information for Post:
I'm Nneka McGee, and I am a doctoral candidate studying the experiences of K-12 educators implementing artificial intelligence applications. If you are interested in completing a voluntary questionnaire and interview to share your experiences, please contact me [redacted]

Always in service,

Nneka

[redacted] 3:32 PM (26 minutes ago)

Hi, Nneka -

I think that would be great. I'm sure this community will have interesting things to contribute!

Copying [redacted] so that she will know you have permission to share this information in the Facebook PLN once it has IRB approval.

Best,

[redacted]

Are you looking for AI resources for the classroom?
Download the five free Hands-On AI Projects for the Classroom guides and other helpful AI education resources from ISTE-GM here!

Request for Permission to Post Research Recruitment Information in Facebook Group Inbox ×

Nneka McGee 5:43 PM (1 hour ago)
Good day, [redacted]all is well. I can't believe how the months have flown by since ISTE! I am writing to you about a request for permission to pos

[redacted] 5:51 PM (54 minutes ago)
to me, [redacted]

Hi Nneka,

Yes, you have my permission to post research recruitment information on the ISTE AI & STEM Explorations Network Facebook Group.

[redacted]

"I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel." Maya Angelou

[redacted]

6:12 PM (34 minutes ago)

Hi, Nneka!

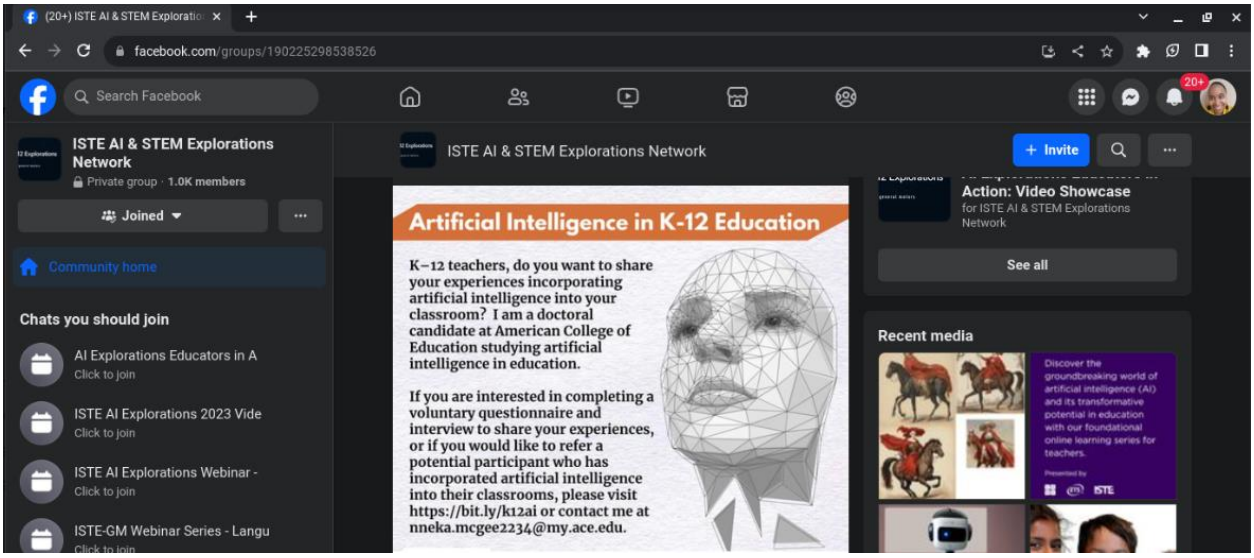
I am glad to hear that your research study is moving forward.

You have my permission as ISTE-GM AI Explorations Project Lead to post your research recruitment information inside our AI Explorations community's ISTE AI & STEM Explorations Network Facebook Group.

Wishing you best on your project and looking forward to opportunities to hear or read about what you find.

Best regards,

[redacted]



Appendix F:

Recruitment Communication

Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools in the United States: A Qualitative Phenomenological Study: Recruitment, Informed Consent Communication, and Questionnaire

Dear Participant,

I'm Nneka McGee, and I am a doctoral candidate at American College of Education studying the lived experiences of K-12 certified teachers who are implementing artificial intelligence applications or who may plan to implement artificial intelligence applications in their learning environments. The purpose is to explore K–12 certified teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation. By participating in the survey, you are confirming that you currently serve as a K-12 certified teacher in a school district (public, charter, or private) located in the United States. Our email communications will occur through your district-provided or employer-provided email address.

The questionnaire consists of seven demographic questions and ten research questions. The results of the study may be published; however, no personally identifiable information will be included. Your identity will remain anonymous. You will need to provide informed consent; which you will be able to review as part of this communication.

Your participation is completely voluntary. There will be no compensation of any kind for your participation in the study. All data collection questionnaires and responses will be stored on a secured hard drive: it is password-protected and only I have access to its contents. The questionnaires will be destroyed within three years of completion of the study.

If you have any questions or concerns, please send an email to Nneka McGee at [redacted]

Always in service,

Nneka McGee

Appendix G:

Informed Consent Form

Section 2 of 5

Informed Consent Document

Prospective Research Participant: Please read this consent form carefully and ask as many questions as you like before you decide whether you want to participate in this research study. You are free to ask questions at any time before, during, or after your participation in this research.

Project Title: Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools in the United States: A Qualitative Phenomenological Study

Researcher: Nneka McGee

Organization: American College of Education

Email: [redacted]

Phone Number: [redacted]

Date of IRB Approval: Please note that this research study has been approved by the American College of Education Institutional Review Board. The IRB approved this study on December 14, 2022. A copy of the approval letter will be provided upon request.

Researcher's Dissertation Chair: Dr. Barry Chametzky

Researcher's Dissertaion Chair Email: [redacted]

Introduction

I am Nneka McGee, and I am a doctoral candidate at American College of Education. I am doing research under the guidance and supervision of my Chair, Dr. Barry Chametzky. I will give you some information about the project and invite you to be part of this research. Before you decide, you can talk to anyone you feel comfortable with about the research. If you have questions, ask me to stop as we go through the information, and I will explain. If you have questions later, feel free to ask me then.

Title

Purpose of the Research

The purpose of this study is to explore K–12 teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation. You are being asked to participate in a research study which will assist with obtaining data regarding the lived experiences of teachers' implementing artificial intelligence in K–12 learning environments. Conducting this qualitative phenomenological study will assist K–12 teachers with selecting professional development opportunities related to the implementation of artificial intelligence applications.

Research Design and Procedures

The study will use a qualitative methodology and phenomenological research design. A questionnaire will be disseminated to specific participants within 24 hours of receiving an executed informed consent document. The study will comprise of 15-20 participants who will participate in a questionnaire. The study may also involve an interview to be conducted via an agreed-upon video conferencing program.

Participant selection

You are being invited to take part in this research because of your experience as a K-12 teacher who can contribute much to the lived experience of artificial intelligence applications in learning environments, which meets the criteria for this study. Participant selection criteria: (1) Currently serving as a K-12 teacher in a school district located in the United States of America; (2) Currently implementing artificial intelligence applications in a learning environment; or (3) Planning to implement artificial intelligence applications in a learning environment.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate. If you choose not to participate, there will be no punitive repercussions.

Right to Refuse or Withdraw

Participation is voluntary. At any time you wish to end your participation in the research study, you may do so by sending me an email explaining you are opting out of the study. There will be no repercussions for leaving the study.

Sharing the Results

At the end of the research study, the results will be available for each participant. It is anticipated to publish the results so other interested people may learn from the research.

Questions About the Study

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact me at [redacted] This research plan has been reviewed and approved by the Institutional Review Board of American College of Education. This is a committee whose role is to make sure research participants are protected from harm. If you wish to ask questions of this group, email IRB@ace.edu.

Certificate of Consent

I have read the information about this study, or it has been read to me. I acknowledge why I have been asked to be a participant in the research study. I have been provided the opportunity to ask questions about the study, and any questions have been answered to my satisfaction. I certify I am at least 18 years of age. I consent voluntarily to be a participant in this study. **Entering your name and date on this form will serve as your digital signature.**

Type your first and last name. *

Short answer text

Enter the date *

Month, day, year

PLEASE KEEP THIS INFORMED CONSENT FORM FOR YOUR RECORDS.

Procedures

We are inviting you to participate in this research study. If you agree, you will be asked to complete a questionnaire and interview questions. The type of questions asked will range from a demographical perspective to open-ended questions about the lived experiences to implement artificial applications and the perceptions regarding the professional development needed for implementation.

Duration

The questionnaire portion of the research study will require 10 - 15 minutes to complete. The time allotted for to complete open-ended questions or interviews conducted via a video conferencing program will be approximately 30 minutes. Prior to an interview, you will be asked to provide permission to have the interview recorded for the sake of having accurate transcripts for data.

Risks

I may ask you to share confidential information, and you may feel uncomfortable talking about some of the topics. You do not have to answer any question or take part in the discussion if you don't wish to do so. You do not have to give any reason for not responding to any question.

Benefits

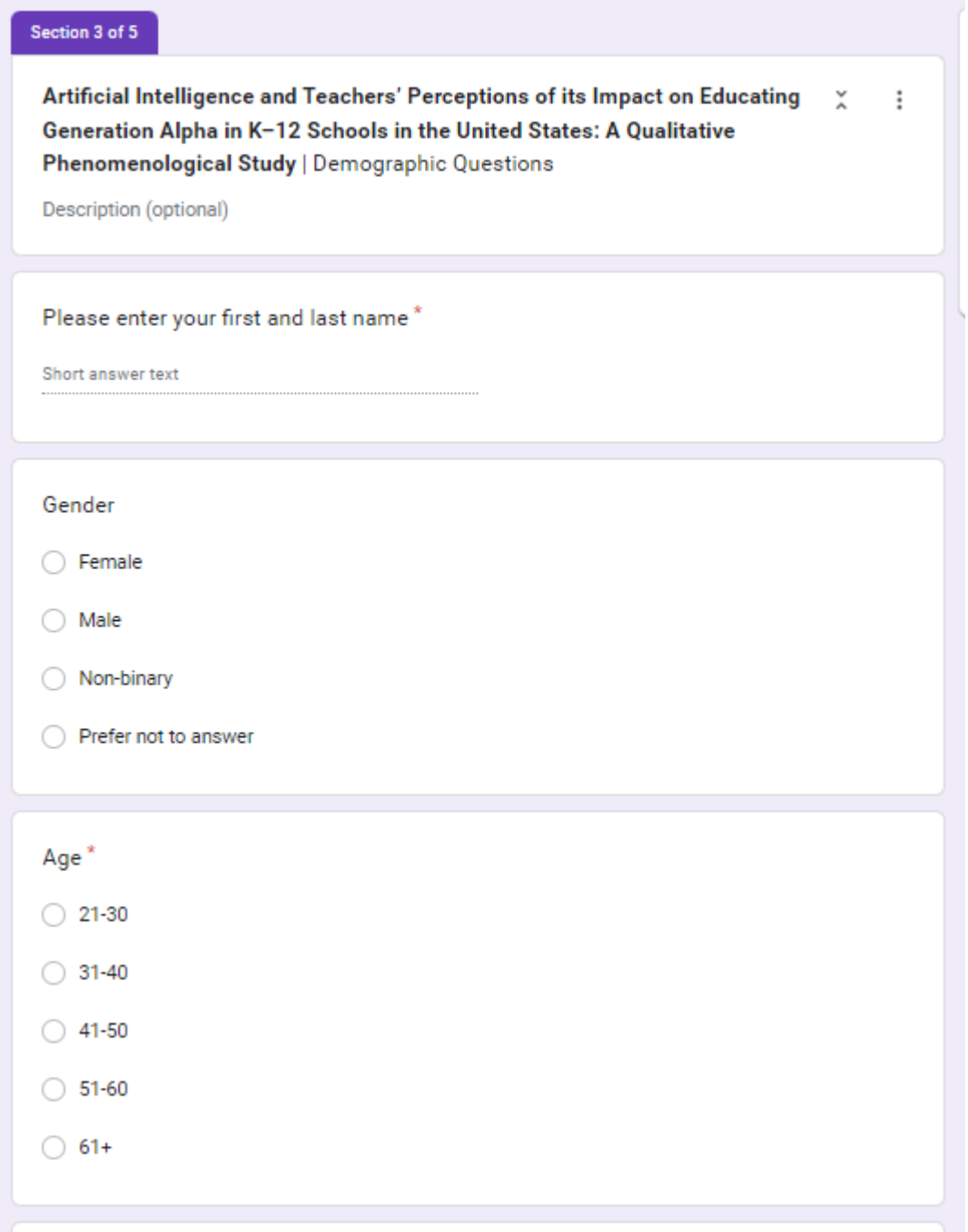
While there will be no direct financial benefit to you, your participation is likely to help us find out more about the lived experiences of K-12 educators who are or plan to implement artificial intelligence applications in classroom learning environments. The potential benefits of this study will aid teachers in selecting professional development related to implementing artificial intelligence in classroom learning environments.

Confidentiality

I will not share information about you or anything you say. During the defense of the doctoral dissertation, data collected will be presented to the dissertation committee. The data collected will be kept in an encrypted computer hard drive. Any information about you will be coded and will not have a direct correlation, which directly identifies you as the participant. Only I will know what your identifier is, and I will secure your information on a password-protected computer hard drive.

Appendix H:

Questionnaire



Select the current grade levels you serve *

- [ ] K-2
- [ ] 3-5
- [ ] 6-8
- [ ] 9-12

Enter the state where you currently serve as an educator. *

Short answer text

Enter the subjects you currently teach. *

Short answer text

Rate your experience with technology integration. *

- ( ) Little to no experience
- ( ) Some experience
- ( ) Moderate experience
- ( ) High experience

Please select one of the following: *

- ○ I am currently implementing artificial intelligence applications in my learning environment.
- ○ I am planning to implement artificial intelligence applications in my learning environment within ...
- ○ I do not plan to implement articificial intelligence applications in my learning environment.

Please indicate if you would like to complete the open-ended questions through an online form or through an interview. *

- ○ Online Form
- ○ Interview via Video Conferencing

Section 4 of 5

Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools in the United States: A Qualitative Phenomenological Study | Open-ended Questions

Description (optional)

(1) Explain why you are implementing or planning to implement artificial intelligence applications in your classroom learning environment. *

Long answer text

(2) Describe the ways you implement or plan to implement artificial intelligence applications in your classroom learning environment. *

Long answer text

(3) Describe your experiences with implementing artificial intelligence applications in your classroom learning environment. *

Long answer text

(4) Describe the frequently occurring positive reactions from students you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment. *

Long answer text

(5) Describe the frequently occurring negative reactions from students you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment. *

Long answer text

(6) Explain how artificial intelligence applications have impacted your teaching style or your learning environment. *

Long answer text

(7) Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments. *

Long answer text

(8) Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence applications. *

Long answer text

(9) What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications? *

Long answer text

(10) What other information would you like to provide about your experience implementing artificial intelligence applications and perceptions regarding the professional development needed for implementation? *

Long answer text

Completion of questionnaire and open-ended questions.

I appreciate you for taking the time for this questionnaire. I will contact you via email to complete member checking. I will also reach out if I need additional clarification regarding your responses to the questionnaire or from the open-ended. As a reminder, the information you provide will be downloaded and stored on a secured hard drive. The information will be destroyed after three years following the end of the study.

~Nneka

Appendix I:

Interview Protocol

Welcome and Introduction [say to participant]: Welcome to the interview. My name is Nneka McGee and I am a doctoral candidate at American College of Education. I am studying K–12 teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation. Thank you for taking some time to speak with me today. Before we continue, can you introduce yourself? [Listen during participant introduction].

[Say to participant]: Thank you for the instruction. Are there any preliminary questions I can answer or record before we continue? **[Pause with adequate wait time]**.

Interview guidelines [say to participant]: I want to thank you again for agreeing to an interview. As part of the research study, you completed a questionnaire with seven demographic questions. During this interview, you will have an opportunity to elaborate on your responses to the questions. You will also have an opportunity to contribute additional information related to the purpose of the study. For each research question, you and I will review your response, and then I will ask if you would like to elaborate on your initial response or provide additional information. If there is a response from the questionnaire that requires more clarification, I will ask during that time. I will take notes during this interview. Let me pause to answer any questions you may have. **[Pause with adequate wait time]**.

[Say to participant]: This interview should take no longer than one hour. I have received your informed consent form. The interview will be recorded per your consent and the information you provide will be downloaded and stored on a secured hard drive. Are you ready to begin? **[Wait for response]**.

Confirm demographic information [say to participant]: I do want to take some time to confirm the demographic information you provided on the questionnaire. As I repeat what you recorded on the questionnaire, can you confirm or correct the information? [If answers affirmatively, confirm demographic information].

Discussion of prompt responses [Say to participant]: Please respond to the following prompt. [Summarize response based on notes]**.** Does your response capture what you want to convey **[If clarification needed, say…Can you clarify what you want to convey?]**

Repeat this step for all ten prompts.

(1) Explain why you are implementing or planning to implement artificial intelligence applications in your classroom learning environment.

(2) Describe the ways you implement or plan to implement artificial intelligence applications in your classroom learning environment.

(3) Describe your experiences with implementing artificial intelligence applications in your classroom learning environment.

(4) Describe the frequently occurring positive reactions from students you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.

(5) Describe the frequently occurring negative reactions from students you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.

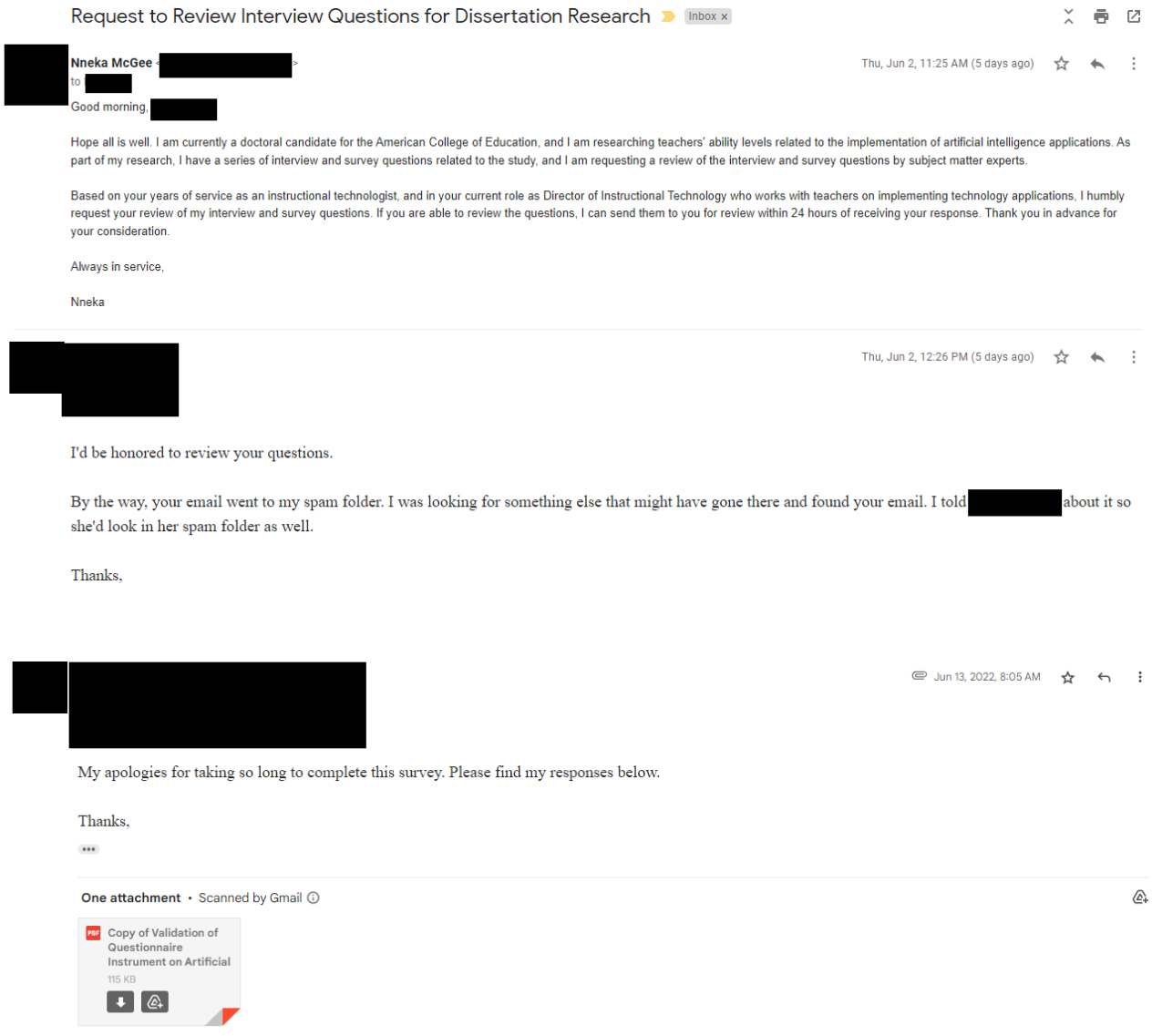
(6) Explain how artificial intelligence applications have impacted your teaching style or your learning environment.

(7) Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments.

(8) Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence applications. (9) What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications? (10) What other information would you like to provide about your experience implementing artificial intelligence applications and perceptions regarding the professional development needed for implementation?
Closing Interview [Say to participant]: I appreciate you for taking the time for this interview. Over the coming weeks, I will transcribe this interview. I will contact you via email to complete member checking. I will also reach out if I need additional clarification regarding your responses to the questionnaire or from the interview. As a reminder, the information you provide will be downloaded and stored on a secured hard drive. The information will be destroyed after three years following the end of the study. Before we close, do you have any questions or concerns I can answer? **[Pause with adequate wait time]**.
Closing statement [Say to participant]: Thank you for taking the time to interview with me this afternoon.

Appendix J:

Subject Matter Expert Emails]



Request to Review Interview Questions for Dissertation Research Inbox ×

[redacted] **Nneka McGee** [redacted] Thu, Jun 2, 11:25 AM (5 days ago)

to [redacted]

Good morning, [redacted]

Hope all is well. I am currently a doctoral candidate for the American College of Education, and I am researching teachers' ability levels related to the implementation of artificial intelligence applications. As part of my research, I have a series of interview and survey questions related to the study, and I am requesting a review of the interview and survey questions by subject matter experts.

Based on your years of service as an instructional technologist, and in your current role as Director of Instructional Technology who works with teachers on implementing technology applications, I humbly request your review of my interview and survey questions. If you are able to review the questions, I can send them to you for review within 24 hours of receiving your response. Thank you in advance for your consideration.

Always in service,

Nneka

[redacted] Thu, Jun 2, 12:26 PM (5 days ago)

I'd be honored to review your questions.

By the way, your email went to my spam folder. I was looking for something else that might have gone there and found your email. I told [redacted] about it so she'd look in her spam folder as well.

Thanks,

[redacted] Jun 13, 2022, 8:05 AM

My apologies for taking so long to complete this survey. Please find my responses below.

Thanks,

•••

One attachment • Scanned by Gmail

Copy of Validation of Questionnaire Instrument on Artificial

115 KB

Validation of Questionnaire Instrument on **Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools: A Qualitative Phenomenological Study by Nneka J. McGee**

Subject Matter Expert Name: [redacted]
Job Title: Director of Instructional Technology and Media Services

Problem Statement: The problem is teachers lack sufficient experience to implement artificial intelligence (AI) applications effectively in K–12 classroom environments.
Purpose Statement: The purpose is to explore K–12 teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation.
Research Methodology and Method: Qualitative research study provides insight and understanding of real-world issues. Phenomenology method serves as a foundation for researchers to explore the lived experiences or phenomena of participants from their point of view.
Please rate the items based on relevance and clarity as they relate to the problem and purpose of the study.
Rating Scale: Relevance 1 - the item is not relevant 2 - the item is somewhat relevant 3 - the item is quite relevant 4 - the item is highly relevant
Rating Scale: Clarity 1 - the item is not clear and needs major revisions 2 - the item is somewhat clear and needs some revision 3 - the item is clear and needs minor revisions 4 - the item is very clear and needs no revision

Item	Relevance Score	Clarity Score	Comments
1. **Please enter your first and last name**	4	4	
2. **Gender** ○ Female ○ Male ○ Prefer not to respond	4	4	
3. **Age** ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61-70 ○ 71+	4	4	
4. Select the grade levels you currently teach ○ K-2 ○ 3-5 ○ 6-8 ○ 9-12	4	4	
5. **Enter the subject(s) you currently teach**:	4	4	
6. **Rate your experience with technology integration** ○ Little to no experience ○ Some experience ○ Moderate experience ○ High experience	4	4	
7. **Select one of the following**: ○ I am currently implementing artificial intelligence applications in my classroom learning environment. ○ I am planning to implement artificial intelligence applications in my classroom learning environment within the next school year.	4	4	I am wondering if there should be a statement about zero interest in AI?
8. Explain why you are implementing artificial intelligence applications in your classroom learning environment.	4	4	
9. Describe the ways you implement artificial intelligence applications in your classroom learning environment.	4	4	
10. Describe your experiences with implementing artificial intelligence applications in your classroom learning environment.	4	4	

11. Describe the frequently occurring positive reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	4	
12. Describe the frequently occurring negative reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	4	
13. Explain how artificial intelligence applications have impacted your teaching style or your learning environment.	4	4	
14. Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments.	4	4	
15. Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence applications.	4	4	
16. What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications?	4	4	

17. What other information would you like to provide?	4	4	

Additional comments from subject matter expert:

Thank you for reviewing the questionnaire instrument. I appreciate your time.

Request to Review Interview Questions for Dissertation Research Inbox ×

[redacted] **Nneka McGee** <[redacted]> Thu, Jun 2, 11:22 AM (5 days ago)
to [redacted]

Good morning [redacted]

Hope all is well. I am currently a doctoral candidate for the American College of Education, and I am researching teachers' ability levels related to the implementation of artificial intelligence applications. As part of my research, I have a series of interview and survey questions related to the study, and I am requesting a review of the interview and survey questions by subject matter experts.

Based on your certification as a K-12 technology applications educator, and in your current role as an instructional technology specialist who works with teachers on implementing applications, I humbly request your review of my interview and survey questions. If you are able to review the questions, I can send them to you for review within 24 hours of receiving your response. Thank you in advance for your consideration.

Always in service,

Nneka

[redacted] Thu, Jun 2, 12:28 PM (5 days ago)
to me

[redacted]

Good Afternoon,
Absolutely I would love to assist.
Thank you.
[redacted]

[redacted] Thu, Jun 9, 12:43 PM

[redacted] attached a document

[redacted] has attached the following document:

Thank you for this opportunity.

[redacted] Copy of Validation of Questionnaire Instrument on Artificial Intelligence in...

Google LLC, 1600 Amphitheatre Parkway, Mountain View, CA 94043, USA
You have received this email because mrs.e.white@gmail.com shared a document with you from Google Docs.

Google

Validation of Questionnaire Instrument on **Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools: A Qualitative Phenomenological Study by Nneka J. McGee**

Subject Matter Expert Name: [redacted]
Job Title: Instructional Technology Specialist

Problem Statement: The problem is teachers lack sufficient experience to implement artificial intelligence (AI) applications effectively in K–12 classroom environments.
Purpose Statement: The purpose is to explore K–12 teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation.
Research Methodology and Method: Qualitative research study provides insight and understanding of real-world issues. Phenomenology method serves as a foundation for researchers to explore the lived experiences or phenomena of participants from their point of view.
Please rate the items based on relevance and clarity as they relate to the problem and purpose of the study.
Rating Scale: Relevance 1 - the item is not relevant 2 - the item is somewhat relevant 3 - the item is quite relevant 4 - the item is highly relevant
Rating Scale: Clarity 1 - the item is not clear and needs major revisions 2 - the item is somewhat clear and needs some revision 3 - the item is clear and needs minor revisions 4 - the item is very clear and needs no revision

Item	Relevance Score	Clarity Score	Comments
1. **Please enter your first and last name**	4	4	
2. **Gender** ○ Female ○ Male ○ Prefer not to respond	4	4	
3. **Age** ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61-70 ○ 71+	4	4	
4. Select the grade levels you currently teach ○ K-2 ○ 3-5 ○ 6-8 ○ 9-12	4	4	
5. **Enter the subject(s) you currently teach**:	4	4	
6. **Rate your experience with technology integration** ○ Little to no experience ○ Some experience ○ Moderate experience ○ High experience	4	4	
7. **Select one of the following**: ○ I am currently implementing artificial intelligence applications in my classroom learning environment. ○ I am planning to implement artificial intelligence applications in my classroom learning environment within the next school year.	4	4	Maybe include another option for those that are not implementing and that maybe are not planning at this time to implement.
8. Explain why you are implementing artificial intelligence applications in your classroom learning environment.	4	4	
9. Describe the ways you implement artificial intelligence applications in your classroom learning environment.	4	4	
10. Describe your experiences with implementing artificial intelligence applications in your classroom learning environment.	4	4	

11. Describe the frequently occurring positive reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	4	
12. Describe the frequently occurring negative reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	4	
13. Explain how artificial intelligence applications have impacted your teaching style or your learning environment.	4	4	Great question!
14. Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments.	4	4	
15. Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence applications.	4	4	
16. What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications?	4	4	

17. What other information would you like to provide?	4	4	

Additional comments from subject matter expert: These questions are spot on with ensuring teachers are prepared for what is next.

Thank you for reviewing the questionnaire instrument. I appreciate your time.

Request to Review Interview Questions for Dissertation Research Inbox ×

Nneka McGee [redacted]
to [redacted] Thu, Jun 2, 11:32 AM (5 days ago)

Good morning, [redacted]

Hope all is well. I am currently a doctoral candidate for the American College of Education, and I am researching teachers' ability levels related to the implementation of artificial intelligence applications. As part of my research, I have a series of interview and survey questions related to the study, and I am requesting a review of the interview and survey questions by subject matter experts.

Based on your years of experience as an electrical engineer, and based on your experience in designing and implementing courses on coding and technology integration, I humbly request your review of my interview and survey questions. If you are able to review the questions, I can send them to you for review within 24 hours of receiving your response. Thank you in advance for your consideration.

Always in service,

Nneka

[redacted] Thu, Jun 2, 2:03 PM (5 days ago)
to me

Hello Nneka,

Thanks for the consideration. I would be happy to participate. Please send me the information.

--

Thanks,

[redacted]

[redacted] Sun, Jun 12, 4:45 PM

Item	Relevance Score	Clarity Score	Comments
1. **Please enter your first and last name**	4	4	
2. **Gender** ○ Female ○ Male ○ Prefer not to respond	3	3	add Other. some people don't mind responding but self identify other than man or woman
3. **Age** ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61-70 ○ 71+	4	4	
[illegible]	4	4	

Item	Relevance Score	Clarity Score	Comments
1. **Please enter your first and last name**	4	4	
2. **Gender** ○ Female ○ Male ○ Prefer not to respond	3	3	add Other. some people don't mind responding but self identify other than man or woman
3. **Age** ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ 61-70 ○ 71+	4	4	
4. Select the grade levels you currently teach ○ K-2 ○ 3-5 ○ 6-8 ○ 9-12	4	4	

5. **Enter the subject(s) you currently teach**:	4	4	
6. **Rate your experience with technology integration** ○ Little to no experience ○ Some experience ○ Moderate experience ○ High experience	4	3	"technology can be a wide umbrella"
7. **Select one of the following**: ○ I am currently implementing artificial intelligence applications in my classroom learning environment. ○ I am planning to implement artificial intelligence applications in my classroom learning environment within the next school year.	4	3	are these the only two options? I don't even plan to touch on AI in the next year. I wouldn't know how to do it at a classroom level based off some of the schools I've been engaging with.
8. Explain why you are implementing artificial intelligence applications in your classroom learning environment.	4	2	not sure if this question is shown regardless of the response to question 7. Might want to add a prompt to say N/A
9. Describe the ways you implement artificial intelligence applications in your classroom learning environment.	4	3	

10. Describe your experiences with implementing artificial intelligence applications in your classroom learning environment.	4	3	
11. Describe the frequently occurring positive reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	2	is there a way to simplify this wording. Even create a section that has a title.
12. Describe the frequently occurring negative reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment.	4	2	is there a way to simplify this wording.
13. Explain how artificial intelligence applications have impacted your teaching style or your learning environment.	4	3	possible examples in description (software tools? Hardware tools?)
14. Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments.	4	4	
15. Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence applications.	4	3	option for NA
16. What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications?	4	4	
17. What other information would you like to provide?	4	4	

Additional comments from subject matter expert: I think there should be more should be more questions to make sure the person actually knows what AI looks like, or how they could envision it in their workplace. The results could be skewed if someone is misinterpreting data analysis and AI. 2: I would possibly ask about if their school has the right technology to actually implement AI practices at a classwide level. Software licenses, computers that can run additional applications, etc. 3: Are their teachers that don't believe they need to teach AI? Or don't see it "as their role" to teach. 4: I'd be interested in their first experience trying to implement AI/ what did they try. How was the resposnse. what prompted them to even try.

Request to Review Interview Questions for Dissertation Research Inbox x

[redacted] Nneka McGee[redacted] Thu, Jun 2, 11:34 AM (5 days ago)
to [redacted]

Good morning [redacted]

Hope all is well. I am currently a doctoral candidate for the American College of Education, and I am researching teachers' ability levels related to the implementation of artificial intelligence applications. As part of my research, I have a series of interview and survey questions related to the study, and I am requesting a review of the interview and survey questions by subject matter experts.

Based on your years of experience as a professional development expert, and based on your experience in designing and implementing professional development events and sessions for educators, I humbly request your review of my interview and survey questions. If you are able to review the questions, I can send them to you for review within 24 hours of receiving your response. Thank you in advance for your consideration.

Always in service,

Nneka

[redacted] Thu, Jun 2, 1:36 PM (5 days ago)
to me

Greetings,

Thanks for the email and the opportunity. Please count me in for the review of interview questions and I look forward to equally learning more and offering feedback along the day. Congratulations on your doctoral journey✨🎉✨

[redacted]

[redacted] Tue, Jul 19, 11:13 PM

Greetings,

Thanks for the opportunity and patience. Please see here: https://docs.google.com/document/d/1kKyDXzt7VTKCEOvYifao1F107yaZ5HnWT6F--YbRvqc/edit?usp=sharing

I hope to learn more about AI and how the approach might support the advancement of student learning. Thank you for serving as a thought partner😊

Best,

[redacted]

Validation of Questionnaire Instrument on **Artificial Intelligence and Teachers' Perceptions of its Impact on Educating Generation Alpha in K–12 Schools: A Qualitative Phenomenological Study by Nneka J. McGee**

Subject Matter Expert Name: [redacted]
Job Title: Executive Director of Professional Learning

Problem Statement: The problem is teachers lack sufficient experience to implement artificial intelligence (AI) applications effectively in K–12 classroom environments.
Purpose Statement: The purpose is to explore K–12 teachers' knowledge to implement artificial intelligence applications and the perceptions regarding the professional development needed for implementation.
Research Methodology and Method: Qualitative research study provides insight and understanding of real-world issues. Phenomenology method serves as a foundation for researchers to explore the lived experiences or phenomena of participants from their point of view.
Please rate the items based on relevance and clarity as they relate to the problem and purpose of the study.
Rating Scale: Relevance-3 GJ 1 - the item is not relevant 2 - the item is somewhat relevant 3 - the item is quite relevant 4 - the item is highly relevant
Rating Scale: Clarity 3-GJ 1 - the item is not clear and needs major revisions 2 - the item is somewhat clear and needs some revision 3 - the item is clear and needs minor revisions 4 - the item is very clear and needs no revision

Item	Relevance Score	Clarity Score	Comments
1. **Please enter your first and last name** [redacted]	3	3	
2. **Gender** o Female X o Male o Prefer not to respond	3	3	
3. **Age** o 21-30 o 31-40X o 41-50 o 51-60 o 61-70 o 71+	3	3	
4. Select the grade levels you currently teach NA o K-2 o 3-5 o 6-8 o 9-12	3	3	
5. **Enter the subject(s) you currently**	3	3	

teach: NA			
6. **Rate your experience with technology integration** o Little to no experience o Some experience o Moderate experience X o High experience	3	3	
7. **Select one of the following**: o I am currently implementing artificial intelligence applications in my classroom learning environment. o I am planning to implement artificial intelligence applications in my classroom learning environment within the next school year. X	3	3	
8. Explain why you are implementing artificial intelligence applications in your classroom learning environment. This is a new concept to me however maybe not for our Instructional Technology department colleagues.	3	3	
9. Describe the ways you implement artificial intelligence applications in your classroom learning environment. Still learning.	3	3	

10. Describe your experiences with implementing artificial intelligence applications in your classroom learning environment. Still learning.			
11. Describe the frequently occurring positive reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment. Still learning.	3	3	
12. Describe the frequently occurring negative reactions you have observed or experienced when implementing artificial intelligence applications in your classroom learning environment. Still learning.	3	3	
13. Explain how artificial intelligence applications have impacted your teaching style or your learning environment. Still learning.	3	3	
14. Explain how you stay up-to-date with artificial intelligence applications related to classroom learning environments. Still learning.	3	3	
15. Describe your experiences with professional development opportunities available for teachers to learn about artificial intelligence	3	3	

applications. Still learning.			
16. What are your perceptions of the professional development opportunities available for teachers to learn about artificial intelligence applications? Still learning.	3	3	
17. What other information would you like to provide?	3	3	

Additional comments from subject matter expert:

Thank you for reviewing the questionnaire instrument. I appreciate your time.