Teachers' Attitudes Toward Artificial Intelligence in Education in Kazakhstan

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Teachers' attitudes towards Artificial Intelligence in education: A study in a private school in Astana

(a) has been approved by the Graduate School of Education Ethics Committee of Nazarbayev University.

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Yours sincerely,

Daniel Hernández Torrano

On behalf of:
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ABSTRACT

The current study aimed to explore the attitudes of teachers from private schools in Kazakhstan toward artificial intelligence in education and investigate the relationships between the attitudes and various external factors, such as age, gender, teaching experience, subject group taught and core and output factors. Such factors included such domains as subjective norms, computer self-efficacy, facilitating conditions, perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use. The study used a non-experimental cross- sectional survey design. The research site for the study was four private schools in Kazakhstan. The participants were selected using non-probabilistic convenience sampling procedure. The sample comprised 101 teachers of various background (gender, age, subject group taught, and teaching experience). Data was collected using a questionnaire based on Technology Acceptance Model (TAM). Data was analyzed using descriptive (mean, standard deviation), inferential (t-test, ANOVA), bivariate (logistic regression) analyses and latent profile analysis.

The results of the study showed that the overall attitudes of teachers toward artificial intelligence in education are neutral-to-positive with some differences across socio-demographic information in relation to the core and output factors. Furthermore, there exist two latent profiles for teachers: those with positive attitude toward artificial intelligence and those with moderate. Considering these profiles, teachers of languages and PE tend to have a more moderate stance toward artificial intelligence in their practice.

Keywords: artificial intelligence, education, attitude, Technology Acceptance Model, private school.

Қазақстандағы Білім Беру Саласындағы Жасанды Интеллектке Мұғалімдердің Көзқарасы

АҢДАТПА

Ағымдағы зерттеу Қазақстандағы жекеменшік мектептердің мұғалімдерінің білім берудегі жасанды интеллектке көзқарасын зерттеуге, сонымен қатар жас, жыныс, педагогикалық тәжірибе, оқытылатын пәндер тобы, негізгі және шығу факторлары сияқты әртүрлі сыртқы факторлардың қарым-қатынасын зерттеуге бағытталған. Мұндай факторларға субъективті нормалар, компьютердің өзіндік тиімділігі, жеңілдететін жағдайлар, жеке қабылдаудың қарапайымдылығы мен пайдалылығы, технологияларға көзқарас және пайдалануға деген әзірлік сияқты домендер жатады. Зерттеуде эксперименттік емес көлденең қималық сауалнама жобасы қолданылды. Зерттеу нысаны Қазақстандағы төрт жекеменшік мектеп болды. Қатысушылар ықтималдық емес ыңғайлы іріктеу үрдісі арқылы таңдалды. Іріктеме әртүрлі міңездемесі бар 101 мұғалімді (жынысы, жасы, оқытатын пәндер тобы және педагогикалық тәжірибесі) құрады. Деректер Технологияны қабылдау моделіне (TAM) негізделген сауалнама арқылы жиналды. Деректер сипаттамалық (орташа, стандартты ауытқу), инференциалды (t-test, ANOVA), бивариаттық (логистикалық регрессия) талдаулар және жасырын профильді талдау арқылы талданды. Зерттеу нәтижелері мұғалімдердің білім берудегі жасанды интеллектке деген жалпы көзқарасы бейтарап-позитивті екенін көрсетті, бірақ негізгі және шығыс факторларға қатысты әлеуметтік-демографиялық ақпарат бойынша кейбір айырмашылықтар анықталды. Сонымен қатар, мұғалімдер үшін екі жасырын профиль бар: жасанды интеллектке оң және орташа көзқараспен қарайтындар. Осы профильдерді ескере отырып, тіл және дене шынықтыру мұғалімдері өз тәжірибесінде жасанды интеллектке қатысты көбіне орташа ұстанымға ие.

Түйін сөздер: жасанды интеллект, білім, көзқарас, технологияны қабылдау моделі, жеке мектеп.

Отношение Учителей к Искусственному Интеллекту в Образовании в Казахстане

АННОТАЦИЯ

Целью настоящего исследования было изучить отношение учителей частных школ Казахстана к искусственному интеллекту в образовании и изучить взаимосвязь между отношением и различными внешними факторами, такими как возраст, пол, опыт преподавания, преподаваемая предметная группа, а также основные и выходные факторы. Такие факторы включали области, как субъективные нормы, самодостаточность в использовании компьютера, способствующие условия, воспринимаемая простота использования, воспринимаемая полезность, отношение к технологии и поведенческое намерение использовать. В исследовании использовалась неэкспериментальная схема перекрестного опроса. Площадкой исследования стали четыре частные школы в Казахстане. Участники были отобраны с использованием удобной невероятностной процедуры выборки. Выборку составил 101 учитель различного происхождения (пол, возраст, преподаваемая предметная группа и опыт преподавания). Данные собирались с помощью анкеты, основанной на модели принятия технологии (TAM). Данные анализировали с использованием описательного (среднее, стандартное отклонение), выводного (t-test, ANOVA), двумерного (логистическая регрессия) анализа и анализа латентного профиля. Результаты исследования показали, что общее отношение учителей к искусственному интеллекту в образовании варьируется от нейтрального до положительного с некоторыми различиями в социально-демографической информации в отношении основных и конечных факторов. Более того, существуют два скрытых профиля учителей: с положительным отношением к искусственному интеллекту и с умеренным. Учитывая эти характеристики, преподаватели языков и

физкультуры, как правило, занимают более умеренную позицию в отношении искусственного интеллекта в своей практике.

Ключевые слова: искусственный интеллект, образование, отношение, модель принятия технологий, частная школа.

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1. Introduction

This study seeks to explore the attitudes of teachers in Kazakhstan toward artificial intelligence (AI) in education, namely technologies that are AI-powered or otherwise involve AI. The purpose of this quantitative, cross-sectional, predictive study is to investigate how the extent to which teachers in Kazakhstan are aware of AI in education is connected to various factors, such as their age, work experience, and subject taught. Participants in this study will include a purposefully selected group of teachers in private schools in Kazakhstan.

The chapter begins with an overview of the context and background that frames the study. Following this is the problem statement, the statement of the purpose, and the research questions that guide the study. The chapter concludes with a discussion of the proposed rationale and significance of this study and definitions of some key terminology used.

1.1 Background Information

The emergence of ChatGPT and other AI-based programs have brough changes to various aspects of life, including education. AI is a set of various algorithms and programs built on these algorithms used for analysis and predictions. Such algorithms normally involve machine learning (ML), but there has been a gradual transition to deep learning (DL) algorithms in AI in education (Chen et al., 2022). DL enables researchers and educators to create more personalized educational experiences given more fine tuning of neural network algorithms that act as a basis of DL.

Teachers are essential to integrating AIEd in school settings. As primary facilitators of formal education, they have the capacity and right to decide what and how AI tools are used in classrooms (UNESCO & Fengchun, 2023). In this direction, Kuleto et al. (2022) state that the attitudes of teachers are essential to integration of AIEd. Not only that, teachers have the implicit power to control how, or at least, to what degree students use AI when doing homework assignments and assessment tasks. In their analysis of teachers' perspectives on

using AI in teaching, Wang et al. (2021) conclude that integration of AI into teaching is not difficult to teachers because teachers' confidence in using AI provides them with a sense of control of the teaching process. At the same time, AIEd still encounters certain challenges, such as "reshaping the research trend from general-purpose intelligence to transfer of intelligence, from computation to cognition, from customization to adaption, from known to unknown, from technology to humanity, and from one-size-fits-all approach to precision" (Yang, 2019).

In this context, there is still a lack of clear comprehension about how AI helps students understand numerous concepts, spanning a variety of subjects, age groups and students' needs. In addition to that, because newness and originality of AIEd, certain teachers may not be fully aware of the technology's benefits for both teaching and learning (Obidike et al., 2011). Whereas the abundance of companies offers associated AI-driven products with various applications of AIEd, most of these are applied with a context of tutoring rather than independent learning and more formal, school-based learning, where an AI software acts as an additional learning resource for students. It is also worth mentioning that such research has not yet been conducted in Kazakhstan, possibly due to the novelty of the field of AIEd and overall delay in technology implementation in Kazakhstani educational field.

1.2 Problem Statement

The benefits of introducing AI in education are apparent: from creating personalized learning experiences to reducing teachers' workload associated with lesson planning, leaving more room for the actual teaching (Ayala-Pazmiño, 2023). However, while the modern educational arena has been filled with various types of software (AI-driven and not), there is still a general lag to incorporate technological solutions into Kazakhstani education as the state digitalization program was presented only in 2017, highlighting the government's goal

of using information and communication technologies as a means of "promoting the rethinking and change of educational systems and processes" (Bokayev et al., 2020, p. 34).

Whereas the government is implementing reforms in education, teachers and students are often left on their own devices when it comes to learning, especially in such important subjects as mathematics. While certain students resort to tutoring services, others turn to technological solutions for help, sometimes only widening a gap in concept understanding and skills mastery from those who – for certain reasons – have not started on more tech-savvy approaches to learning. Teachers, in the meantime, are often left by themselves, betaking whatever resources available, with no clear studies with guidelines about AI implementation and integration in education, which may greatly affect their intentions to use the technology (Uygun, 2024).

To this end, research investigating teachers' attitudes toward AIEd in Kazakhstan is necessary. It will help both educators and students create better learning experiences: the former will be able to promote seamless learning that goes beyond a physical classroom and possibly even curriculum and the latter will have a chance to grasp concept and develop skills associated with mathematics education, such as abstract thinking, analytical thinking, etc. A study by Obidike et al. (2011), which investigated technology awareness of 500 teachers in Nigeria, found out that while teachers were aware of the tools that would improve students' literacy, they were unaware of the use of those tools. This is just one example of a concept in education (literacy) in one country, more than a decade before the arrival of ChatGPT and software alike. More research into teachers' attitude toward AIEd will help understand how exactly AI can be used to promote more equitable and efficient education because teachers' attitude toward a technology defines their actual use of it.

1.3 Purpose of the Study

The purpose of this study is twofold. First, this study will explore the attitudes toward AI in education of teachers in private schools in Kazakhstan. Second, it will investigate the relationship between the attitudes and various factors, such as age, gender, teaching experience, subject group taught, subjective norms, computer self-efficacy and facilitating conditions.

1.4 Research Questions

RQ1: *What are the attitudes of teachers towards artificial intelligence technologies in education (AIEd)?* This question aims to explore the attitudes teachers have toward AIEd.

RQ2: *How do individual, professional and other factors shape teachers' attitudes toward AIEd?* This question investigates various factors that may influence teachers' attitudes toward AIEd.

RQ3: *Can teachers be classified into distinctive profiles based on their attitudes toward AIEd?* This question explores whether teachers can be classified into certain profiles with regard to their attitudes toward AIEd.

RQ4: *How these profiles differ across individual (e.g., gender) and professional (i.e., subject, years of teaching experience)?* This question puts forth the notion that these profiles are distinct across various attributes.

1.5. Significance of the Study

The findings of this study will complete a gap in the literature by indicating teachers' attitudes of the novel technology and subsequent outlining of key factors that limit this awareness. Additionally, the results of the study might be useful for school leaders seeking to implement AIEd. Likewise, it is also expected that curriculum designers and teachers might learn about the connections between certain subjects and how the teachers of these subjects are more or less likely to adopt AIEd. Finally, this study will provide an analysis of

correlations between teachers' awareness of AIEd and other factors, which might be crucial for policy makers aiming to review both national and international standards in education, especially involving teacher development, assessment, and academic integrity.

1.6 Summary

This chapter established the rationale for the current study. It provided the context and background information related to AIEd in Kazakhstan. Also, it stated the research problem, the purpose, and the research questions. Finally, it presented the significance of the study and the possible audience who benefit from this research.

The remaining of this thesis is organized in five chapters. In Chapter 2, literature review pertaining to the matter of this study is presented. In Chapter 3, the methodology used in this study is outlined. Chapters 4-6 outline the findings, discussion and conclusion of the study.

2. Literature Review

2.1 Artificial Intelligence and Learning

AI has become a popular educational tool in recent years as it facilitates a learning process that is student-centered and enables students to learn faster, yet the role of teacher will never diminish (Mohamed et al., 2022). Given that children have a great capacity for using electronic devices and software, technological aids to teaching and learning are what Audibert (2021) refers to as "easy-to-follow". One of the domains of education where AI has already made its first steps is mathematics. The advent of Khanmigo (Khan Academy's AI tutor), mathematics education is now on the verge of becoming AI-integrated. While Audibert (2021) believes that using convolutional neural network[1] can facilitate better understanding of math concepts by children, it is still important to understand what are different applications of AI in facilitating a better mathematics learning experience at different educational levels and various educational contexts? It must be acknowledge that mathematics is just one example of AIEd, with other subjects and domains waiting to be transformed by AI.

Even though AI has been a popular topic of discussions both in industry and academia for decades, there is still ongoing research of its effects on learning. Given the complexity of both AI and learning, one can appreciate the fact that currently there are limited studies on implementation of AI-assisted learning in mathematics (Mohamed et al., 2022). Another potential explanation is a lack of connection between AI and pedagogical theory (Zawacki-Richter, 2019, as cited in Mohamed et al., 2022).

In their systemic review of intelligence tutoring systems (ITS), Pappas and Drigas (2016) seek to bridge the aforementioned gap by categorizing both pedagogical frameworks (something they call "intelligent techniques") and mathematical domains, including problem

[1] A type of algorithm often used in artificial intelligence applications

solving, algebraic and arithmetic operations, fractions and decimals, geometry, standardized tests, and mathematical logic. In her research report, Schnoberg (2022) finds that higher usage of IXL, a personalized learning platform, "was positively associated with better performance on the ACT[2]" (p. 1).

2.2 Artificial Intelligence and Teaching

Although most teachers are likely to understand some benefits of AIEd, there is still a general lack of understanding how AI will help their jobs. In a study by McKinsey (Bryant et al., 2020), it was found out that out of 50 hours teachers work on average, they spend less than half of that time in direct interaction with students. Because teacher-student interaction is vital to students' success, such data demonstrates how teachers have to spend time on other activities, greatly diminishing academic success of their students. To this end, AIEd can improve the efficiency of teachers' other duties, such as administrative or clerical work, as stated in the U. S. Department of Education Office of Educational Technology's new policy report "Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations".

When contemplating AIEd, one needs to consider the role of teacher in the era of AI. In their comprehensive review of promises and challenges of AI for teachers, Celik et al. (2022), put forth the idea that teachers will put on the roles of orchestrators of learning for AI systems to understand pedagogical approaches by collecting appropriate data.

2.3 Technology Acceptance Model

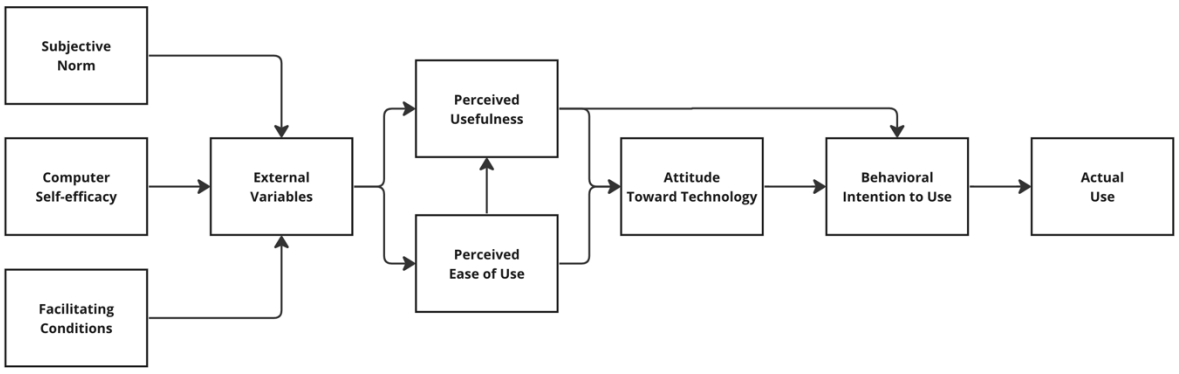
The Technology Acceptance Model is a framework used to understand how users' acceptance and use of a technology is formed. Within this model, such domains as perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use

[2] American College Testing, a standardized test that comprises mathematical and verbal reasoning questions

are viewed (Davis, 1989). Perceived ease of use is regarded as how a particular technology is regarded from ease of interaction, while perceived usefulness – potential enhancement of the job brought on by this technology. According to this model, the behavioral intention to use a technology is affected by the attitude toward this technology. Additionally, TAM includes external variables, the use of which has been extended over time (Guner & Acartürk, 2018). Among the external variables, subjective norm (Beldad & Hegner, 2017), computer self-efficacy (Ariff et al., 2012) and facilitating conditions (Sukendro et al., 2020) can be attributed to technology acceptance. Figure 1 below presents the structure of the Technology Acceptance Model with external variables, demonstrating how these external variables can potentially influence both perceived ease of use and perceived usefulness, which may thus affect the actual use of the technology.

Figure 1

Technology Acceptance Model



There have been numerous studies involving the TAM to assess educational technologies in teaching and learning practice. Nikou and Economides (2018) found that the TAM contributed for nearly half of the STEM teachers' intentions to use the mobile-based assessment in their work. Wang et al. (2021) expanded the external variables to include anxiety and found that a combination of such external variables formed a 70.4% change in

behavioral intention to use AI by teachers. Darayseh (2023) used the TAM to find that the acceptance of science teachers in the United Arab Emirates to use AI is high.

2.4 Empirical Studies and Factors Affecting Teachers' Attitudes

In general, there has been a limited number of studies on educators' opinions about AI (McGrath et al., 2023c). Of the present studies, Eyüp and Kayhan (2023c) used anxiety and attitude toward AI scales to survey 232 pre-service Turkish language teachers and found that these respondents' attitudes were at moderate levels with no differences across gender in terms of anxiety. Given variety of educational contexts, it is thus crucial to study how various domains of teachers' socio-demographic data (including, but not limited to gender) come into play to shape teachers' attitudes toward AIEd.

In their comparison of teachers' attitudes toward technologies AI in comparison to technologies without it, Cojean et al. (2023) surveyed 115 teachers online and found that while teachers' perception of AI was accurate (as an effective tool from time-input standpoint), teachers' acceptability of technologies with AI and without it was similar.

In their study of 16 teachers' professional development and human factors that influence teachers' attitudes toward AI-based educational technology, Nazaretsky et al. (2021) found that confirmation bias may take place in the educational practice in the era of AI: teachers tend to trust their previous knowledge more over AI recommendations. To this end, investigating how teaching experience may influence teachers' attitudes is important.

Insights pertinent to this study can be drawn from an extensive study of 452 pre-service teachers in Germany by Zhang et al. (2023b). Their study confirmed that perceived ease of use and perceived usefulness are two of the most important factors influencing the intention to use a technology of AI. The study found that AI anxiety does not directly affect the intention to use AI, but there were some differences in terms of gender: female teachers

were more likely to experience AI anxiety, which may be explained by subjective norm and facilitating conditions, highlighting the need for further research into external variables.

The study by Uygun (2024) of 74 teachers in Turkey reveals that the majority of participants were positive about AIEd. The study also found that years of service had no relationship with teachers' attitude toward AIEd and that teachers' opinions on AIEd did not vary according to their fields of study. This may call for further research on teachers' teaching experience and how subject groups may affect their positions on AIEd.

2.5 Summary

In this chapter, main conceptual underpinnings to the AIEd are presented, along with an overview of the role of the teacher in the AI era. The Technology Acceptance Model conceptual framework is also presented to aid the further analysis of teachers' attitudes toward AIEd, along with the factors that may affect these attitudes, underscoring how a combination of these factors (both socio-demographic and external) may affect teachers' attitudes toward AIEd.

In the next chapter, the methodology used in this study will be presented.

3. Methodology

This chapter describes the study's research methodology and includes discussions around the following areas: research design, research site, description of the research sample, research methods, data collection tools and procedures, data analysis, and ethical considerations of this study. The purpose of this study is to explore the attitudes of teachers in private schools in Kazakhstan toward AIEd and investigate the relationships between the attitudes and various factors, such as age, gender, teaching experience, subject group taught, and others.

The chapter is organized into eight sections: in the first section, the research design of the study is presented, followed by a description of the participants in the second section and the research site in the third section. The data collection tools and procedures are presented in the fourth and fifth sections, respectively. The data analysis part is included in the sixth section. Next, ethical issues are described in the seventh section, followed by a chapter summary in the eight sections.

3.1 Research Design

A quantitative approach was in used in this study to explore the attitudes of teachers in private schools in Kazakhstan toward AIEd and investigate the relationships between the attitudes and various factors, such as age, gender, teaching experience, subject group taught, subjective norms, computer self-efficacy and facilitating conditions. According to Creswell (2014), such quantitative approach "identifies a research problem based on trends in the field or on the need to explain why something occurs" (p. 13), which demonstrates how this approach is appropriate for this study.

More specifically, a non-experimental cross-sectional survey design was used to achieve the purpose of this study. Given the popularity of AI, a cross-sectional survey is most pertinent as "this design has the advantage of measuring current aptitudes or practices

(Creswell, 2014, p. 377). Leavy (2017) puts for the idea that "surveys are typically used for ascertaining individuals' attitudes, beliefs, opinions, or their reporting of their experiences and/or behaviors." (p. 101). Therefore, a cross-sectional survey is appropriate for the purpose of the current study. In addition to that, because "cross-sectional surveys do offer the opportunity to assess relations between variables and differences between subgroups in a population" (Visser et al., 2000), this particular research design is suitable for understanding which factors shape teachers' attitudes towards AIEd and if teachers can be classified into distinctive profiles based on their attitudes toward AIEd.

3.2 Participants

The target population in this study involves 101 teachers from four private schools in Kazakhstan. A non-probabilistic maximum variation sampling approach was applied to engage participants for this study and recruit participants with a diversity of personal and background characteristics. A total of 101 respondents took part in the study. Of these participants, 69 were female (68.32%) and 32 were male (31.68%). Of the 101 participants, 46 lie within 18-30 age group (45.54%), whereas the rest – 55 are within 30+ age group (54.46%). As for teaching experience, 41 of the respondents had 0-5 years of experience (40.60%), while 60 participants had more than five years of teaching experience (59.40%). Table 1 presents the frequencies of subject groups taught by these teachers, a part of socio-demographic information. According to the information in Table 1, the participants represent various subject groups, including tutors and assistants.

Table 1

Frequencies of Participants' Subject Groups

Subject	Counts	% of Total	Cumulative %
Humanities	34	33.66 %	33.66 %
Languages	27	26.73 %	60.40 %
Physical education (PE)	6	5.94 %	66.34 %
STEM	26	25.74 %	92.08 %
Tutor/Assistant	8	7.92 %	100.00 %

Thus, the participants represented both male and female teachers, with more female teachers being a typical scenario in a school setting. Additionally, the participants represented teachers engaged in a variety of subjects, including STEM[3], language, humanities, physical education, and tutors. Other relevant characteristic of this sample was a range of teaching experiences.

3.3 Research Site

This study took place in four private schools in Kazakhstan. The primary reason for selecting these particular educational establishments was convenience and availability because the researcher of this study works at one of these particular schools and has direct line of communication to other private schools in Kazakhstan. Another argument in favor of selecting such schools is that these are general education schools that include teachers of various subjects and with different backgrounds, which is essential to the given research questions. In addition, the staff of selected schools comprises roughly 200 members, out of which at least 150 are directly involved in teaching, either as teachers or as tutors or assistant teachers.

3.4 Data Collection Tools

[3] Science, technology, engineering, mathematics

A questionnaire based on the Technology Acceptance Model (TAM, Davis, 1989) was adapted to this study to identify teachers' attitudes toward AIEd. The TAM incorporates such domains as external variables, core variables, and output variables, and has been used extensively to explore opinions toward technology in educational and non-educational settings. The TAM-based survey is a self-report questionnaire consisting of three sections: social-demographic information, external variables, and core and output variables. This survey had been devised on the basis of previous research on school teachers' attitudes toward multimedia use (Weng et al., 2018), teachers' adoption of digital technology in education (Scherer et al., 2019), and a study of motivation and facilitating conditions for mobile learning (Camilleri & Camilleri, 2022). These studies delve into different variables of the TAM, each having its own focus. This study combines the instruments from these studies and presents a version that incorporates relevant variables and appropriate wording of the items on the questionnaire. The questionnaire consisted of 32 items to capture socio-demographic information (4 items); external variables, including subjective norms (5 items), computer self-efficacy (2 items), facilitating conditions (3 items); and the TAM-core and output variables, including perceived ease of use (4 items), perceived usefulness (4 items), attitudes toward technology (5 items), and behavioral intention to use (5 items).

The external variables included biographic and professional information, such as gender, age, subject group taught and professional teaching experience. The inclusion of these variables was essential to further classification of teachers based on their attitude toward AIEd.

In addition, the external variables included such domains as subjective norms, computer self-efficacy, and facilitating conditions. A subjective norm is defined as an individual's perception that he or she should behave in a particular way because people who are important to him or her think this way (Fishbein & Ajzen, 1975, as cited in Scherer et al., 2019). In the

case of this study, a subjective norm is viewed as a person's perception that he or she should use AI because people who are important to him or her think he or she should. An example of a questionnaire item on subjective norm used in the study is "People whose opinions I value think I should use AI." Computer self-efficacy can be understood as the extent to which an individual believes to be able to perform a task on a computer (Compeau & Higgins, 1995, as cited in Scherer et al., 2019). For this particular study, this variable was understood as a person's ability to perform a task using AI. An example of a questionnaire item on computer self-efficacy used in the study is "I feel confident in navigating among different AI tools and applications." Facilitating conditions represented the extent to which an individual believes that there were organizational and technical resources to help him or her with the use of technology (Venkatesh, 2003, as cited in Scherer et al., 2019), AI in particular. Together, these "external variables represented personal capabilities next to contextual factors" (Scherer et al., 2019). An example of a questionnaire item on facilitating conditions used in the study is "I can get help from others when I experience difficulties using AI."

The core and output variables involved so-called TAM-core variables (Scherer et al., 2019) and an output variable. Among TAM-core variables, there were perceived ease of use (PEOU), perceived usefulness (PU), and attitudes toward technology (ATT). The output variable was behavioral intention to use (BI). According to Davis (1989), perceived ease of use is the extent to which an individual believes using technology is effortless. In the case of this particular study, this translates as perceived ease of use of AIEd. Davis (1989) states that perceived usefulness is the extent to which an individual believes a technology would improve his or her performance at work. Adapting this definition for the purposes of this particular study means that perceived usefulness is understood as the extent to which teachers believe AI would help their job performance. Behavioral intention to use is understood as an individual's intention to use AIEd or not.

In this TAM-based questionnaire, participants rated their attitudes, perceptions and opinions of certain AI-related practices on a 7-point Likert scale (0 = strongly disagree, 1 = disagree, 2 = somewhat disagree, 3 = neutral, 4 = somewhat agree, 5 = agree, 6 = strongly agree). Descriptive statistics can demonstrate general trends in attitudes for all the domains by comparing the mean values for all listed items.

3.5 Data Collection Procedures

First, the researcher obtained an ethics approval from the review board. A detailed description of the study was submitted to the Graduate School of Education Institutional Research Ethical Committee (GSE IREC) of Nazarbayev University. Having successfully obtained an approval from the GSE IREC, the researcher proceeded with obtaining a permission to access from the proposed research site.

The researcher wrote a formal letter and sent it via corporate email to the school administration. A brief presentation about the purpose, risks, and benefits of research was included in the email. In the email, the researcher specified the willingness to answer and discuss any questions that may arise about the study (see email invitation attached). After the formal approval by the school administration, a link to the online survey was shared via corporate emails and job-related Whatsapp chats. It is important to mention that the link had a short explanatory note about the research and a reminder that any participant was free to quit the survey at any moment of time. Additionally, the voluntary nature of the survey was emphasized at any instances when any reminders about filling out the questionnaire are made.

The first page of the questionnaire was dedicated to a detailed consent form that was included a short summary of the study, its objectives, estimated time to complete the questionnaire, the voluntary nature of the study and the rights of the participants, the risks and associated steps taken to mitigate these risks, and the potential benefits of the study. The items of the questionnaire were only displayed once a participant had read and agreed to the

consent form. In case participants did not express willingness to participate in the study, the survey proceeded to its end, without displaying any items or other information. The survey took approximately 10 to 15 minutes to complete. The participants had at least two weeks to complete the questionnaire. The questionnaire was made available in three languages: English, Kazakh, and Russian.

Friendly reminders by the researcher were sent via corporate email and Whatsapp chats one and two weeks after the initial take. It was made clear that only the researcher and the research supervisor have access to the data.

3.6 Data Analysis

The process of data analysis commenced once the data had been obtained. The first step was to upload the data into the Jamovi software on the researcher's laptop from Google Forms in either XLS or CSV format. Before data could be analyzed, reliability and validity tests were performed. To evaluate the reliability of data supplied, Cronbach's alpha values were examined, where a value between 0.70 and 0.95 indicated satisfactory reliability (Tavakol & Dennick, 2011). To evaluate the validity of the data, confirmatory factor analysis was done. Model fit was evaluated using numerous goodness-of-fit indices: χ^2 to degree of freedom ratio ($\chi 2$ /df), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). Values $\chi^2/df < 3$, RMSEA and SRMR < 0.06, and CFI and TLI > 0.95 indicated a good model fit (Hu and Bentler, 1999; Schreiber et al., 2006).

Descriptive statistics were used to address the first research question by calculating mean and associated standard deviation for each item and comparing the obtained values against the aforementioned Likert scale.

To address the second research question, independent samples t-tests an ANOVA test were performed by using core and output (dependent) variables and comparing them against

external variables (fixed factors). The reason for using ANOVA was because the dataset included more than two groups; additionally, a one-way ANOVA did not require groups to be of equal size as it "compares variation within a group (on average) to the equivalent variation based on group means' variation" (Ross & Willson, 2018).

For the third research question, a latent profile analysis (LPA) was done to classify the obtained item responses by using relative fit of data as determining factors for the number of classes. Four models with different number of classes were tested and compared using the measurements of fit such as Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Entropy. Models were tested in a progressive order, starting with two classes, having all measurements recorded after every class increase. The AIC is a relative fit index that was developed as an approximation of out-of-sample predictive accuracy of a model (Ames et al., 2023b). A lower value of AIC indicates a better fit of a model. Similar to AIC, a lower BIC indicates a more reliable model fit. Sinha et al. (2020) recommend that for studies with sample size limitations (<300), both AIC and BIC should be used, highlighting the importance of using both of these metrics in this study. Since balancing differences between AIC and BIC is difficult (Vrieze, 2012), other fit statistics were measured for model selection, such as entropy. It must be noted that even though entropy was used as a measurement of fit, it was not used for model selection as higher entropy values indicate model over-fitness (Sinha et al., 2020).

In order to answer the fourth research question, a multinomial logistic regression was performed to explore the relationship between factors and attitudinal profiles about the use of AIEd. To implement this, obtained profiles from LPA were used as dependent variable, while other variables were used as covariates. Similar to PCA, model fit measures included AIC, but also deviance and the coefficient of determination (R^2). Lower values of deviance and higher values of R^2 indicate a better predictive ability of the model, but AIC needs to be

considered too because some indicators may contradict other (Allison, 2014). Additionally, BLRT test was used for model selection. Using model coefficients with higher p values, factors more likely determining profiles were identified. To determine the likelihood of a certain variable being associated with a particular latent profile Z-scores and odds ratios (ORs) with 95% confidence intervals (CIs) were calculated.

3.7 Ethical Issues

All participants, teachers, school administration, staff and otherwise involved people were notified of research purposes and benefits. Informed consent was taken from all the participants prior to filling out the questionnaire. The participation in the study was completely voluntary and the participants will have an option to withdraw at any moment of the study. The study was conducted online, and no information such as first and last names, emails, phone numbers, and IP addresses were collected, ensuring anonymity. In addition, each participant's response was assigned an index to keep the identity of the participant private.

The confidentiality of the participants was protected by storing any collected data in a password-protected laptop which belongs to the researcher only. Also, all reports emerging from this study do include the name of the school or the names of the participants nor any information that could potentially reveal their identities. All findings were reported in an aggregate form, further impeding identification. Additionally, only the researcher and the research supervisor had access to the data. There were no paper versions of the survey. No paper copies of the data were printed and/or otherwise distributed.

3.8 Summary

This chapter presents the research methodology used in this study, including the research design, sample, site, data collection, procedures and analysis. In addition to that, ethical considerations are mentioned.

In the following chapters, the findings of the study are presented along with discussion and conclusion of the study.

4. Findings

This chapter describes the study's findings and includes information about the following: descriptive analysis, differences in external and output variables across socio-demographic data, teachers' profiles based on attitudes toward artificial intelligence in education, and relationship between the attitude profiles and socio-demographic characteristics.

4.1 Descriptive Analysis

The following section provides information about descriptive analysis and confirmation factor analysis performed during this study. Both validity and reliability analyses are included in this section.

Table 2 presents factor loadings that were calculated as part of confirmatory factor analysis. For this analysis, factors are split across two domains: external variables that include subjective norms, computer self-efficacy and facilitating conditions, and output variables that include perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use, as presented in Table 3.

Table 2

Confirmatory Factor Analysis: External Variables

Factor Loadings

Factor	Indicator	Estimate	SE	Z	p	Stand. Estimate
Subjective norm	5. SN1	1.08	0.13	8.12	< .001	0.73
	6. SN2	0.80	0.13	6.00	< .001	0.58
	7. SN3	1.30	0.13	10.25	< .001	0.85
	8. SN4	1.29	0.13	10.32	< .001	0.85
	9. SN5	1.19	0.12	10.04	< .001	0.84
Computer Self-efficacy	10. CSS1	1.34	0.13	10.66	< .001	0.87
	11. CSS2	1.37	0.14	9.98	< .001	0.83
Facilitating Conditions	12. FC1	1.39	0.12	11.73	< .001	0.92
	13. FC2	0.97	0.13	7.33	< .001	0.67
	14. FC3	1.11	0.13	8.84	< .001	0.77

Table 3

Confirmatory Factor Analysis: Output Variables

Factor Loadings

Factor	Indicator	Estimate	SE	Z	p	Stand. Estimate
Perceived Ease of Use	15. PEOU1	1.04	0.12	8.45	< .001	0.74
	16. PEOU2	1.26	0.11	11.44	< .001	0.90
	17. PEOU3	1.21	0.10	11.61	< .001	0.90
	18. PEOU4	1.15	0.11	10.68	< .001	0.86
Perceived Usefulness	19. PU1	0.95	0.11	8.40	< .001	0.74
	20. PU2	1.24	0.11	10.85	< .001	0.88
	21. PU3	1.02	0.13	8.03	< .001	0.72
	22. PU4	1.11	0.11	10.10	< .001	0.83
Attitude Toward Technology	23. ATT1	1.06	0.10	10.35	< .001	0.84
	24. ATT2	1.07	0.11	9.80	< .001	0.81
	25. ATT3	1.19	0.10	11.32	< .001	0.89
	26. ATT4	1.10	0.11	10.25	< .001	0.84
	27. ATT5	1.17	0.12	9.97	< .001	0.82
Behavioral Intention to Use	28. BITU1	1.16	0.10	11.05	< .001	0.88
	29. BITU2	1.21	0.12	10.31	< .001	0.84
	30. BITU3	1.04	0.12	9.01	< .001	0.77
	21. BITU4	0.94	0.12	8.09	< .001	0.72
	32. BITU5	1.15	0.12	9.25	< .001	0.79

Table 4 presents the descriptive statistics and reliability coefficients for key variables. Cronbach's alpha coefficients across measures ranged from $\alpha = .84$ to .92, suggesting satisfactory to good internal consistency of the scores in the sample.

Table 4

Descriptive Statistics, Internal Consistency and Correlation Coefficients

		items	M	SD	α	1	2	3	4	5	6	7
1	Subjective norms	5	4.71	1.21	.88	-						
2	Computer self-efficacy	2	4.77	1.49	.84	.54	-					
3	Facilitating conditions	3	5.06	1.29	.84	.53	.78	-				
4	Perceived ease of use	4	4.88	1.22	.91	.66	.53	.52	-			
5	Perceived usefulness	4	4.91	1.17	.87	.56	.67	.64	.77	-		
6	Attitude toward technology	5	4.93	1.17	.92	.69	.58	.59	.84	.81	-	
7	Behavioral intention to use	5	4.84	1.16	.89	.73	.58	.58	.81	.76	.84	-

Note. All correlation coefficients are statistically significant at $p < .001$ level.

According to the information in Table 4, given the 7-point Likert scale (where a score of 1 corresponds to strong disagreement and a score of 7 corresponds to strong agreement), most respondents somewhat agree with items in the questionnaire because the mean values range from 4.77 to 5.06 with standard deviation values between 1.16 and 1.49. It must be noted that facilitating conditions domain had the highest mean score, while subjective norms and computer self-efficacy had the lowest mean scores among the variables. This indicates a neutral-to-positive attitude toward AIEd. Another important aspect that needs to be highlighted is that external variables and output variables demonstrate similar mean and standard deviation values, potentially alluding to the fact that external factors shape teachers' attitudes toward AIEd.

4.2 Differences in External and Output Variables Across Socio-demographic Data

The following chapter examines the findings from t-tests and ANOVA with respect to socio-demographic data of the participants including gender, age, subject-group taught, and teaching experience.

Gender. An independent samples t-test was conducted to compare male and female teachers' attitudes toward AIEd broken down by external and output variables. Table 5 demonstrates the aforementioned t-test. A Mann-Whitney U test was performed because normality assumption was not met for all variables. According to the information in Table 5, there were statistically significant differences in mean values of subjective norms between male teachers (M = 5.50, SD = 1.35) and female teachers (M = 4.52, SD = 1.11); U = 799.50, $n1$ = 32, $n2$ = 69, p = 0.026, r = 0.28 *(n1 – number of male teachers, n2 – number of female teachers)*. There were also differences in mean values of facilitating conditions between male teachers (M = 5.30, SD = 1.36) and female teachers (M = 4.95, SD = 1.24); U = 873.50, $n1$ = 32, $n2$ = 69, p = 0.091, r = 0.21. These results suggest that male teachers tend to experience higher subjective norm to use AI in their work and also tend to have more conditions at work that facilitate this use.

Table 5

Independent Samples t-test (Mann-Whitney U) Across Gender

	Statistic	p	Mean difference	Effect Size
Subjective norm	799.50	0.026	-0.60	0.28
Computer self-efficacy	1011.50	0.499	-0.00	0.08
Facilitating conditions	873.50	0.091	-0.33	0.21
Perceived ease of use	985.50	0.388	-0.25	0.11
Perceived usefulness	1053.00	0.712	-0.00	0.05
Attitude toward technology	884.50	0.109	-0.40	0.20
Behavioral intention to use	903.50	0.143	-0.40	0.18

Age groups. An independent samples t-test was conducted to compare the attitudes toward AIEd of teachers of different age groups broken down by external and output variables. Table 6 demonstrates the aforementioned t-test. A Mann-Whitney U test was performed because normality assumption was not met for all variables. According to the information in Table 6, there were statistically significant differences in mean values of computer self-efficacy between younger teachers (18-30 years old) (M = 5.10, SD = 1.71) and older teachers (30+) (M = 4.50, SD = 1.21); U = 871, $n1$ = 46, $n2$ = 55, p = 0.007, r = 0.3*1 (n1 – number of younger teachers, n2 – number of older teachers)*. There were also statistically significant differences in mean values of facilitating conditions between younger teachers (M = 5.27, SD = 1.44) and older teachers (M = 4.90, SD = 1.12); U = 935, $n1$ = 46, $n2$ = 55, p = 0.024, r = 0.26. Additionally, there were statistically significant differences in mean values of perceived usefulness between younger teachers (M = 5.21, SD = 1.24) and older teachers (M = 4.67, SD = 1.05); U = 863, $n1$ = 46, $n2$ = 55, p = 0.006, r = 0.31. There were statistically significant differences in mean values of attitude toward technology between younger teachers (M = 5.13, SD = 1.27) and older teachers (M = 4.77, SD = 1.07); U = 973.50, $n1$ = 46, $n2$ = 55, p = 0.047, r = 0.23. It must be noted too that there were statistically significant differences in mean values of behavioral intention to use between younger teachers (M = 5.03, SD = 1.24) and older teachers (M = 4.69, SD = 1.07); U = 971.50, $n1$ = 46, $n2$ = 55, p = 0.045, r = 0.23. These results suggest that younger teachers tend to have higher computer skills to use AI in their work and also tend to have more conditions at work that facilitate this use. In addition, younger teachers tend to exhibit higher predisposition toward AI's usefulness and overall demonstrate a more positive attitude toward technology and intention to use it.

Table 6

Independent Samples t-test (Mann-Whitney U) Across age

	Statistic	p	Mean difference	Effect Size
Subjective norm	1158.00	0.467	0.20	0.08
Computer self-efficacy	871.00	0.007	1.00	0.31
Facilitating conditions	935.00	0.024	0.67	0.26
Perceived ease of use	989.50	0.060	0.50	0.22
Perceived usefulness	863.00	0.006	0.75	0.32
Attitude toward technology	973.50	0.047	0.40	0.23
Behavioral intention to use	971.50	0.045	0.40	0.23

Teaching experience. An independent samples t-test was conducted to the attitudes of teachers with different teaching experience toward AIEd broken down by external and output variables. Table 7 demonstrates the aforementioned t-test. A Mann-Whitney U test was performed because normality assumption was not met for all variables. According to the information in Table 7, there were statistically significant differences in mean values of computer self-efficacy between less experienced teachers (0-5 years of teaching experience) (M = 5.27, SD = 1.46) and more experienced teachers (more than five years of teaching experience) (M = 4.43, SD = 1.42); U = 808, $n1$ = 41, $n2$ = 60, p = 0.003, r = 0.34 *(n1 – number of less experienced teachers, n2 – number of more teachers)*. There were also statistically significant differences in mean values of facilitating conditions between less experienced teachers (M = 5.45, SD = 1.05) and more experienced teachers (M = 4.80, SD = 1.37); U = 877.50, $n1$ = 41, $n2$ = 60, p = 0.014, r = 0.29. Additionally, there were also statistically significant differences in mean values of perceived ease of use between less experienced teachers (M = 5.20, SD = 1.10) and more experienced teachers (M = 4.66, SD = 1.27); U =900, $n1$ = 41, $n2$ = 60, p = 0.026, r = 0.26. There were also statistically significant

differences in mean values of perceived usefulness between less experienced teachers (*M* = 5.27, *SD* = 1.20) and more experienced teachers (*M* = 4.67, *SD* = 1.09); *U* = 820.*50, n1* = 41, *n2* = 60, *p* = 0.005, *r* = 0.33. In addition, there were also statistically significant differences in mean values of attitudes toward technology between less experienced teachers (*M* = 5.27, *SD* = 1.02) and more experienced teachers (*M* = 4.71, *SD* = 1.22); *U* =893.50, *n1* = 41, *n2* = 60, *p* = 0.020, *r* = 0.27. There were also statistically significant differences in mean values of behavioral intention to use between less experienced teachers (*M* = 5.17, *SD* = 1.07) and more experienced teachers (*M* = 4.63, *SD* = 1.18); *U* =882, *n1* = 41, *n2* = 60, *p* = 0.016, *r* = 0.28.

Table 7

Independent Samples t-test (Mann-Whitney U) Across Teaching Experience

	Statistic	p	Mean difference	Effect Size
Subjective norm	1148.50	0.575	0.20	0.07
Computer self-efficacy	808.00	0.003	1.00	0.34
Facilitating conditions	877.50	0.014	0.67	0.29
Perceived ease of use	909.00	0.026	0.50	0.26
Perceived usefulness	820.50	0.005	0.75	0.33
Attitude toward technology	893.50	0.020	0.60	0.27
Behavioral intention to use	882.00	0.016	0.60	0.28

Subject groups. A one-way non-parametric ANOVA was conducted to compare the values of variables across subject groups. Table 8 presents differences across subject groups. A Kruskal-Wallis test was used because normality assumption was not met for most variables. The results show statistically significant differences in mean values of perceived ease of use, attitude toward technology and behavioral intention to use across subject groups. Overall, pair-wise comparisons demonstrated that PE teachers tend to have a significantly

different positions toward PEOU, ATT and BITU in comparison to the teachers of other subject groups.

As per the mean values of perceived ease of use, teachers of humanities and PE teachers exhibited a considerable difference (W = -3.12, p = 0.18), alongside teachers of languages and PE teachers (W = -3.32, p = 0.13). Similarly, PE teachers and STEM teachers demonstrated a difference (W = 3.32, p = 0.13); likewise, PE teachers and tutors/assistants showed a significant difference (W = 3.58, p = 0.084).

When it comes to the mean values of attitude toward technology, teachers of humanities and PE teachers exhibited a considerable difference (W = -2.95, p = 0.23), alongside teachers of languages and PE teachers (W = -4.30, p = 0.020). Similarly, PE teachers and STEM teachers demonstrated a difference (W = 3.66, p = 0.072); likewise, PE teachers and tutors/assistants showed a significant difference (W = 3.69, p = 0.068).

As for the mean values of behavioral intention to use, teachers of humanities and PE teachers exhibited a considerable difference (W = -3.44, p = 0.11), alongside teachers of languages and PE teachers (W = -4.54, p = 0.012). Similarly, PE teachers and STEM teachers demonstrated a difference (W = 4.07, p = 0.032); likewise, PE teachers and tutors/assistants showed a significant difference (W = 3.58, p = 0.084).

Table 8

ANOVA Across Subject Groups

Kruskal-Wallis

	χ^2	df	p	ε^2
Subjective norm	6.34	4	0.175	0.06
Computer self-efficacy	2.38	4	0.667	0.02
Facilitating conditions	4.36	4	0.359	0.04
Perceived ease of use	9.89	4	0.042	0.10
Perceived usefulness	6.25	4	0.181	0.06
Attitude toward technology	11.24	4	0.024	0.11
Behavioral intention to use	13.36	4	0.010	0.13

4.3 Teachers' Profiles Based on Attitudes Toward Artificial Intelligence in Education

Table 9 provides the LPA model estimates and class comparisons for the one- to four-profile model solutions tested in this study. The two-profile model with varying variances and varying covariances (Model 6) demonstrated the best fit according to the AIC, BIC, and entropy, and the BLRT test. Thus, the two-profile model with varying variances and varying covariances was considered optimal and selected in this study (i.e., model 6, class 2).

Table 9

Latent Profile Models and Class Comparisons

Model	Class	AIC	BIC	Entropy	BLRT_p
1	1	2331.18	2367.80	1.00	
1	2	2054.19	2111.72	0.90	0.01
1	3	1913.77	1992.22	0.90	0.01
1	4	1855.04	1954.41	0.90	0.01
2	1	2331.18	2367.80	1.00	
2	2	2035.70	2111.54	0.93	0.01
2	3	1880.73	1995.79	0.93	0.01
2	4	1838.60	1992.89	0.94	0.01
3	1	1735.58	1827.11	1.00	
3	2	1724.43	1836.88	0.85	0.05
3	3	1706.75	1840.12	0.91	0.01
3	4	1745.45	1899.74	0.84	0.75
6	1	1735.58	1827.11	1.00	
6	2	1650.50	1836.17	0.87	0.01
6	3	1695.60	1975.41	0.91	1.00
6	4	1712.67	2086.63	0.94	0.95

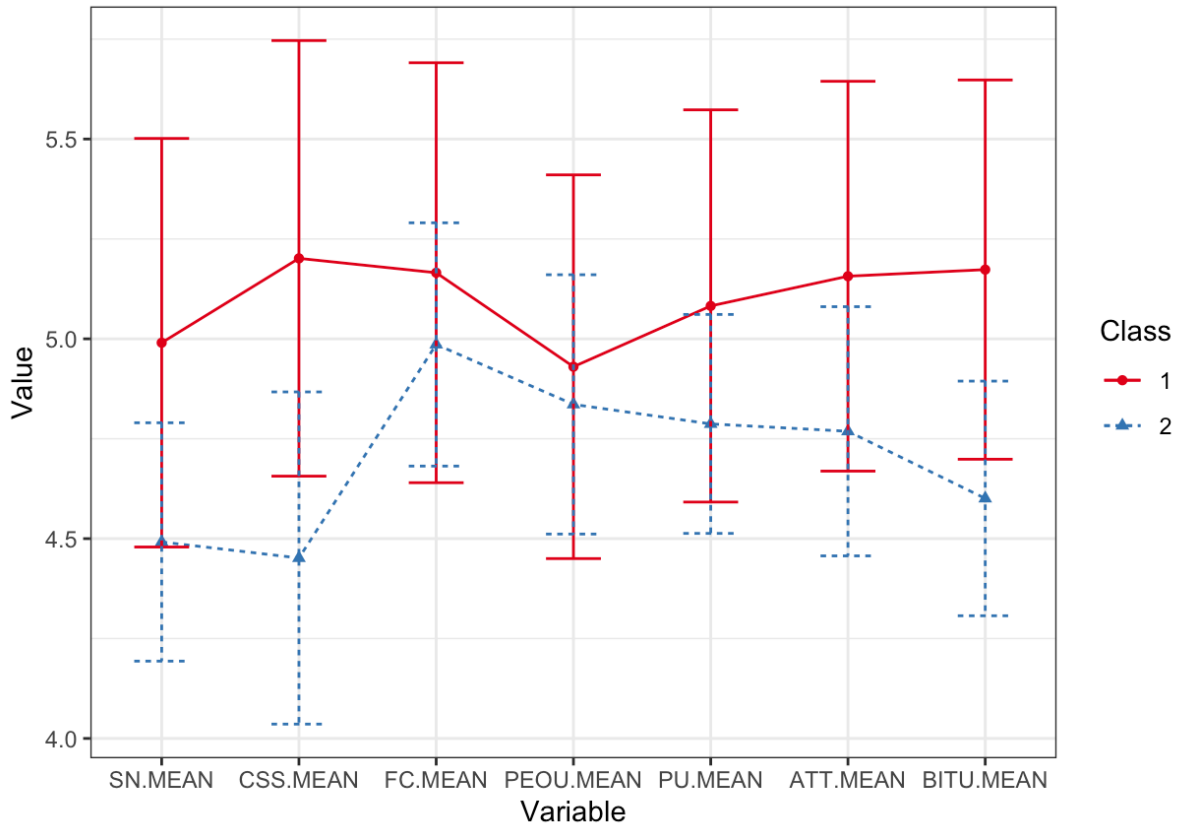
Note. AIC = Akaike Information Criteria, BIC = Bayesian information Criteria; BLRT = bootstrapped
likelihood ratio test.

Figure 2 presents the latent profile solution consisting of two classes (i.e., profiles): Class 1, labeled Positive attitude toward AIEd (n = 44; 43.6%) and Class 2, labeled Moderate attitude toward AIEd (n = 57; 56.4%). Means and standard deviation values of scores in Class 1 were characterized by higher levels of subjective norms, computer self-efficacy, facilitating conditions, perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use. It must be noted, too, that the differences between the two classes were particularly highlighted in the domains of subjective norms, computer self-efficacy,

attitude toward technology and behavioral intention to use, whereas the values of scores in Class 2 were characterized by lower levels across corresponding domains.

Figure 2

Teachers' Latent Profiles on Attitudes Toward Artificial Intelligence



Caption. Two distinctive profiles of teachers' attitudes toward artificial intelligence in education: Class 1 = Positive attitude (43.6%), higher, more positive values across all domains; Class 2 = Moderate attitude (56.4%), relatively lower values across all domains.

4.4 Relationship Between the Attitude Profiles and Socio-demographic Characteristics

Table 10 presents the binomial logistic regression for predicting latent profiles. The binomial logistic approach was selected because there were two classes in the latent profile analysis. The positive attitude class (Class 1) was designated as the reference level and was compared against the other, moderate attitude class (Class 2). The results indicated that the

teachers in moderate attitude class (those with moderate attitude toward AIEd compared to positive attitude class, were more likely to be from languages and PE subject groups. **Table 10**

Socio-demographic Characteristics Associated With Latent Class Membership

Model Coefficients - Membership M6C2

		95% Confidence Interval					
Predictor	Estimate	Lower	Upper	SE	Z	p	Odds ratio
Intercept	-0.81	-1.79	0.17	0.50	-1.62	0.104	0.44
1. Gender:							
Male – Female	-0.20	-1.14	0.74	0.48	-0.42	0.676	0.82
3. Subject:							
Languages – Humanities	1.30	0.16	2.43	0.58	2.24	0.025	3.66
Physical education (PE) – Humanities	2.03	-0.30	4.36	1.19	1.71	0.088	7.63
STEM – Humanities	0.10	-0.97	1.17	0.55	0.18	0.853	1.11
Tutor/Assistant – Humanities	1.22	-0.47	2.91	0.86	1.42	0.157	3.39
2. Age:							
30+ – 18-30	0.35	-0.71	1.41	0.54	0.65	0.516	1.42
4. Teaching experience:							
5+ years – 0-5 years	0.68	-0.43	1.79	0.57	1.20	0.229	1.97

Note. Estimates represent the log odds of "Membership M6C2 = 2" vs. "Membership M6C2 = 1"

5. Discussion

The present study aimed to explore the attitudes of teachers in private schools in Kazakhstan toward AIEd and investigate the relationships between the attitudes and various factors, such as age, gender, teaching experience, subject group taught and others.

This chapter consists of five sections: the first one discusses overall teachers' attitudes toward artificial intelligence in education, while the second one explores the differences in these attitudes across socio-demographic factors. The chapter then continues with teachers' latent profiles on attitudes and corresponding relationships with aforementioned factors, followed by a conclusion.

5.1 Teachers' Attitudes Toward Artificial Intelligence in Education

The findings revealed that, in general, teachers demonstrate a neutral-to-positive attitude toward AIEd, which aligns with the position taken by French teachers, who did not view AI as a threat to their work, but rather view it as something that is less time consuming for the given workload input (Cojean et al., 2023). While some pre-service teachers may experience AI anxiety (AIA), but nonetheless demonstrate moderate attitude toward AIEd (Eyüp & Kayhan, 2023), the current study finds teachers attitude to be neutral-to-positive. This contrast between pre-service and active-duty teachers' attitudes can be explained by active-duty teachers' capacity building in the field, utilizing some AI tools in actual practice and the fact that most studies have focused on active-duty teachers. Overall, the teachers show a neutral-to-positive attitude toward AIEd (RQ1), as such domain as facilitating conditions having the highest mean score, while subjective norms and computer self-efficacy having the lowest mean scores. This overall position aligns with the position of teaches in the USA (OECD, 2023).

5.2 Differences in Attitudes Across Socio-demographic Factors

The findings also demonstrated that male teachers are more likely to experience higher levels of subjective norms and have more facilitating conditions to use AI at work. This aligns with previous studies' findings: female teachers often demonstrate higher levels of AIA (Zhang et al., 2023), which shapes their more moderate attitude toward AIEd. Explanations for such differences often include less exposure to STEM by females, females' tendency for risk aversion and gender stereotyping (Zhang et al., 2023). As for the age groups, the current study yielded results that go along with previous studies about teachers' age and their computer self-efficacy, including AI self-efficacy. The study's findings indicate that younger teachers (less than 30 years old) tend to have better computer skills and utilize facilitating conditions better to implement AI. This agrees with the confirmed hypothesis that younger teachers are more competent when it comes to computer use (Šabić et al., 2021). The study's findings about teaching experience are tied closely to age: less experienced teachers (less than five years of teaching experience) demonstrated more positive attitude toward AI through such domains as perceived ease of use (tied to computer self-efficacy), perceived usefulness, attitude toward technology and behavioral intention to use. This contrasts the findings by Darayseh (2023), who found that such domains as gender and teaching experience do not produce statistically significant differences in behavioral intention to use AI. An important note that needs to be addressed in this contrast is that Darayseh refers to behavioral intention to use, which is only one of multiple domains of the output variables that describe a teacher's attitude toward AIEd. For the subject group taught, PE teachers demonstrated statistically significant differences in attitudes: their mean values for perceived ease of use, attitude toward technology and behavioral intention to use contrasted those of other teaching disciplines. Some scholars state that PE teachers' lack of competence and incomplete training may offer an explanation to their reserved attitude toward ICT (Koh et al., 2021), which offers a possible explanation as to why their attitudes toward AIEd were

different from those of teachers of other subject groups. In general, individual and professional factors vary differently in their influence on teachers' attitudes toward AIEd (RQ2).

5.3 Teachers' Latent Profiles on Attitudes Toward Artificial Intelligence

The study demonstrated the existence of two latent profiles of teachers: those with positive attitude toward AI and those with moderate attitude. Previous studies on teachers' attitudes that included latent profile analyses focused predominantly on teachers' attitudes toward ICT in general. Even though a direct comparison between AI and ICT is unlikely as AI constitutes a part of ICT competencies, some contrast between LPA classes might reveal interesting insights into how teachers' attitudes are different toward AIEd. Lee (2023) divides teachers into three classes: 'minimal users', 'moderate users', and 'versatile users', whereas the current study divides teachers only in two classes (positive and moderate attitudes). In this study, Thurm (2018) uses an LPA to find four classes of teachers attitudes toward technology: 'positive beliefs–frequent users', 'positive beliefs–infrequent users', 'negative beliefs–infrequent users', and 'negative beliefs–frequent users'. Even though the focus of his research was on teachers' frequency of use, this model practically demonstrates that teachers are either positive or negative about technology in their practice, whereas the current study describes teachers attitudes rather as positive or moderate. Overall, teachers can be classified into two classes according to their attitudes toward AIEd positive and moderate (RQ3).

5.4 Relationship Between the Profiles and Socio-demographic Factors

The results of the logistic regression revealed that the teachers in moderate attitude class (those with moderate attitude toward AIEd compared to positive attitude class, were more likely to be from languages and PE subject groups. This can be potentially explained by an overview of the works of scientists and the subsequent notion that PE teachers often do not

have enough competencies and do not undergo enough proper professional training to use ICT and AI in teaching (Koh et al., 2021). According to the study by Eyüp and Kayhan (2023b), pre-service language teachers in Turkey have moderate (both positive and negative) position toward AI. The researchers further state that teachers' moderately positive attitudes may further be influenced by capacity building. Altogether, both language and PE teachers' reservations about AIEd might be explained by relatively low awareness and the need for proper training on the matter of AI's use in education. On the whole, the aforementioned classes (positive and moderate attitudes toward AI) differ predominantly across subject group taught: teachers of languages and PE tend to have a more reserved position toward AI (RQ4).

5.5 Conclusion

Overall, teachers in Kazakhstan hold a neutral-to-positive attitude toward artificial intelligence, which mostly aligns with the views of the colleagues from other countries. It must be mentioned that teachers' positions are most pronounced when viewed from facilitating conditions domain (highest mean score), while subjective norms and computer self-efficacy are in the lower parts of the spectrum – all of the three lie within the external variables portion of the TAM, whereas TAM core domains (perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use) also demonstrate relatively high mean scores, indicating a generally positive attitude toward AI. As for the factors, both individual and professional factors differ in their influence on attitude toward AIEd. Next, there are two latent profiles of teachers with respect to their attitudes toward AIEd: positive and neutral. Additionally, these classes differ mostly across the subject group taught component.

6. Conclusion

6.1 Introduction

This chapter will present final conclusions of the study, implications for theory and practice, and limitations and future research recommendations. The current study aimed to explore the attitudes of teachers from private schools in Kazakhstan toward AIEd and investigate the relationships between the attitudes and various external factors, such as age, gender, teaching experience, subject group taught and core and output factors.

This chapter consists of several parts. Firstly, the implications for policy makers, teachers and school administrators will be provided. Secondly, limitations of the study will be investigated, and suggestions for future research will be given. Next, the chapter will be sealed with final remarks.

6.2 Summary of key Findings

On the whole, teachers in Kazakhstan have a neutral-to-positive attitude toward AIEd with some significant differences across gender, age, subject group taught and teaching experience. There are two latent profiles: positive and neutral, which are mostly predefined by the subject group taught: teachers of PE and languages exhibit a generally more reserved position toward AIEd.

6.3 Implications for Educational Practice

Having considered the findings and associated insights from this study, one can make certain recommendations for policy makers, teachers and the school administrators.

While certain countries have adopted AI use policies (some even have gone as far as to adopt an AI use policy in education and even created the ministry of AI), Kazakhstan has not declared a clear position on AI. Educational institutions have to resort to global best

practices and come up with their own policies that are often difficult to follow or lack clear cohesiveness. As the findings of this study indicate, teachers' attitudes often translate into the actual use if they are provided with proper training on technology use. However, before educational institutions, and schools in particular, can embark on this journey of professional development in the era of AI, a nationwide policy on AI use must be developed to address concerns related to data privacy and AI ethics (UNESCO, 2021).

In order for teachers to embrace the ethical and efficient use of technology for the benefit of students, a comprehensive training program must be developed that takes into account not just language of instruction (as it is done within the framework of multilingual education), but also socio-demographic and professional data, such as the age and subject taught by the teachers. Potential professional development sessions on AI use in education should include differentiation scaffolding for teachers of different subjects, as some might be more receptive to the new technology due to variety and complexity of both core factors (subjective norms, computer self-efficacy, and facilitating conditions) and output factors (perceived ease of use, perceived usefulness, attitude toward technology and behavioral intention to use).

While the output factors are usually individual and are unique to most teachers, the core factors can help school administrator shape better professional learning communities within their schools to facilitate a smooth AI adaptation. Understanding how teachers' subjective norms affect their position on AI use, school administrators can design better professional development sessions, which offers benefits from both leadership and corporate perspectives. Providing teachers with conditions necessary to help them develop computer self-efficacy and AI self-efficacy may act as a powerful instrument in the hands of caring and modern school leader.

6.4 Limitations and Future Research Recommendations

One limitation of the current study is that it included teachers only from private schools in Kazakhstan. Private schools in Kazakhstan are a minority, meaning that the attitudes of the majority of teachers in Kazakhstan have been left out of this research. In addition, private schools usually operate on an independent budget, which usually means that they are more likely to hire more competent teachers (subjective norms, computer self-efficacy) and/or facilitate better, up-to-date professional development for their teachers. Private schools are also usually better equipped, which may also shape a different attitude toward AI and ICT in general (facilitating conditions).

Another possible limitation of this study is that not all teachers have a common understanding of AI and how it can be used in education. For some teachers, it is yet another buzzword that they perceive as something foreign and fleeting. Thus, they may not be inclined to study it further, not to mention to understand how to use it in their practice. This is where the issue of English language comes into play. Since most of AI tools are in English, it is English-speaking teachers who are most likely to adopt the new tools. This limitation of the study is linked to the previous one as most teachers in private schools are more likely to have higher levels of English proficiency compared to the teachers in mainstream schools in Kazakhstan.

One limitation of the study had to do with the fact that AI is a rapidly evolving phenomenon in today's world, potentially leading to a scenario where participants' opinions may have changed greatly, rendering this snapshot obsolete. Over the course of this study, dozes, if not hundreds, of new AI-driven educational technology solutions have emerged, along with tutorials, media materials and policies in certain countries, which may have played a significant role in reshaping teachers' attitudes toward AIEd.

Relatively small sample size and non-probabilistic nature of this study may limit the generalization of the findings and may thus act as yet another limitation.

Taking into account these limitations and the findings of this study, future studies in Kazakhstan should involve teachers from various school across the nation to better understand how the type of school plays into shaping teachers' attitudes and opinions. A study on AI policies will be extremely useful as it will help educators and policy makers build a common language when it comes to AIEd. Such research will allow educators to see both advantages and disadvantages of AI use under different scenarios and within different educational challenges, greatly expanding the current use cases of the technology. Finally, more research needs to be done in the field of professional development to bring about the previously mentioned capacity building among all involved stakeholders. Studying best global practices on teaching training, learning opportunities and practice exchange will facilitate a comprehensive understanding and better use of AIEd.

6.5 Concluding Remarks

Considering the findings of this study, it is necessary to study global best practices on AI use in the field of education to create not only effective policies, but to promote professional development of teachers, leading to ethical and effective use of AI for both teaching and learning.

References

Allison, P. D. (2014). Measures of Fit for Logistic Regression. *SAS Support*. http://statisticalhorizons.com/wp-content/uploads/GOFForLogisticRegression-Paper.pdf

Ames, A. J., Ezike, N., & Myers, A. (2023b). Model-data fit evaluation: posterior checks and Bayesian model selection. In *Elsevier eBooks* (pp. 279–289). https://doi.org/10.1016/b978-0-12-818630-5.10038-7

Ariff, M. S. M., Yeow, S. M., Zakuan, N., Jusoh, A., & Bahari, A. Z. (2012). The effects of Computer Self-Efficacy and Technology Acceptance model on behavioral intention in internet banking systems. *Procedia: Social & Behavioral Sciences*, *57*, 448–452. https://doi.org/10.1016/j.sbspro.2012.09.1210

Artificial Intelligence and the Future of Teaching and Learning - Office of Educational Technology. (2023, May 24). Office of Educational Technology. https://tech.ed.gov/ai-future-of-teaching-and-learning/

Audibert, R. B. (2021). *FINNger - Applying artificial intelligence to ease math learning for children*. https://www.semanticscholar.org/paper/FINNger-Applying-artificial-intelligence-to-ease-Audibert-Maschio/6a4b3da4895c1aeedc415c7439da7e2bb566e0c7

Ayala-Pazmiño, M. (2023). Artificial intelligence in Education: Exploring the potential benefits and risks. *593 Digital Publisher CEIT*, *8*(3), 892–899. https://doi.org/10.33386/593dp.2023.3.1827

Beldad, A., & Hegner, S. M. (2017). Expanding the Technology Acceptance Model with the Inclusion of Trust, Social Influence, and Health Valuation to Determine the Predictors of German Users' Willingness to Continue using a Fitness App: A Structural Equation

Modeling Approach. *International Journal of Human-computer Interaction*, *34*(9), 882–893. https://doi.org/10.1080/10447318.2017.1403220

Bokayev, B., Torebekova, Z., & Davletbayeva, Z. (2020). Implementation of information and communication technology in educational system of Kazakhstan: challenges and opportunities. *Gosudarstvennoe Upravlenie I Gosudarstvennaâ Služba*, *4*, 32–43. https://doi.org/10.52123/1994-2370-2020-75-4-32-43

Bryant, J., Heitz,C., Sanghvi, S., & Wagle, D. (2020, January 14). *How artificial intelligence will impact K-12 teachers.* McKinsey. https://www.mckinsey.com/industries/education/our-insights/how-artificial-intelligence-will-impact-k-12- teachers

Camilleri, M. A., & Camilleri, A. C. (2022b). Learning from anywhere, anytime: Utilitarian motivations and facilitating conditions for mobile learning. *Technology, Knowledge, and Learning*, *28*(4), 1687–1705. https://doi.org/10.1007/s10758-022-09608-8

Celik, I. (2023). Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, *138*, 107468. https://doi.org/10.1016/j.chb.2022.107468

Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022). The Promises and Challenges of Artificial Intelligence for Teachers: a Systematic Review of Research. *TechTrends*, *66*(4), 616–630. https://doi.org/10.1007/s11528-022-00715-y

Chen, X., Zou, D., Xie, H., Cheng, G., & Liu, C. (2022). Two Decades of Artificial Intelligence in Education: Contributors, Collaborations, Research Topics, Challenges, and Future Directions. *Educational Technology & Society*, *25*(1), 28–47. https://www.jstor.org/stable/48647028

Cohen, L., Manion, L., & Morrison, K. R. B. (2018). *Research Methods in Education*.

Cojean, S., Brun, L., Amadieu, F., & Dessus, P. (2023). Teachers' attitudes towards AI: what is the difference with non-AI technologies? *Proceedings of the Annual Meeting of the Cognitive Science Society*, 45. Retrieved from https://escholarship.org/uc/item/0r55s1jb

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. MIS Quarterly, 19(2), 189–211. https://doi.org/10.2307/249688

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. Pearson Education.

Darayseh, A. A. (2023). Acceptance of artificial intelligence in teaching science: Science teachers' perspective. *Computers & Education: Artificial Intelligence*, *4*, 100132. https://doi.org/10.1016/j.caeai.2023.100132

Davis, F.D. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Q. 1989, 13, 319–340.

Eyüp, B., & Kayhan, S. (2023). Pre-Service Turkish Language Teachers' anxiety and attitudes toward artificial intelligence. *International Journal of Education and Literacy Studies*, *11*(4), 43–56. https://doi.org/10.7575/aiac.ijels.v.11n.4p.43

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

Guner, H., & Acartürk, C. (2018). The use and acceptance of ICT by senior citizens: a comparison of technology acceptance model (TAM) for elderly and young adults. *Universal Access in the Information Society*, *19*(2), 311–330. https://doi.org/10.1007/s10209-018-0642-4

Kishida, K., Tsuda, M., Takahashi, F., & Ishikawa, S. I. (2022). Irritability and mental health profiles among children and adolescents: A result of latent profile analysis. *Journal of Affective Disorders*, *300*, 76-83. https://doi.org/10.1016/j.jad.2021.12.045

Koh, K. T., Tan, L., Camiré, M., Paculdar, M. a. A., & Chua, W. G. A. (2021). Teachers' and students' perceptions of factors influencing the adoption of information and communications technology in physical education in Singapore schools. *European Physical Education Review*, *28*(1), 100–119. https://doi.org/10.1177/1356336x211017949

Kuleto, V., Ilić, M., Bucea-Manea-Tonis, R., Ciocodeică, D., Mihălcescu, H., & Mindrescu, V. (2022). The Attitudes of K–12 Schools' Teachers in Serbia towards the Potential of Artificial Intelligence. *Sustainability*, *14*(14), 8636. https://doi.org/10.3390/su14148636

Leavy, P. (2017). Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. New York, NY: The Guilford Press. ISBN 9781462514380. 300 pp. (Paperback). *Family and Consumer Sciences Research Journal*, *47*(1), 101–102. https://doi.org/10.1111/fcsr.12276

McGrath, C., Pargman, T. C., Juth, N., & Palmgren, P. J. (2023c). University teachers' perceptions of responsibility and artificial intelligence in higher education - An experimental philosophical study. *Computers and Education. Artificial Intelligence*, *4*, 100139. https://doi.org/10.1016/j.caeai.2023.100139

Hidayat, R., Mohamed, M. S. B., Suhaizi, N. N. M., Sabri, N. B. M., Mahmud, M. K. H. B., & Baharuddin, S. S. B. (2022). Artificial intelligence in mathematics education: A systematic literature review. *International Electronic Journal of Mathematics Education*, *17*(3), em0694. https://doi.org/10.29333/iejme/12132

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A multidisciplinary Journal*, *6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Nazaretsky, T., Cukurova, M., Ariely, M., & Alexandron, G. (2021). Confirmation bias and trust: human factors that influence teachers' attitudes towards AI-based educational technology. *CEUR Workshop Proceedings*. https://doi.org/10.35542/osf.io/dzqju

Nikou, S. A., & Economides, A. A. (2018). Factors that influence behavioral intention to use mobile-based assessment: A STEM teachers' perspective. *British Journal of Educational Technology*, *50*(2), 587–600. https://doi.org/10.1111/bjet.12609

Obidike, N. D., Anyikwa, N., & Enemou, J. O. (2011). Teachers' awareness of the existence and the use of technology to promote children's literacy instruction. *African Journal of Teacher Education*, *1*(1). https://doi.org/10.21083/ajote.v1i1.1576

OECD [DIRECTORATE FOR EDUCATION AND SKILLS EDUCATION POLICY COMMITTEE]. (n.d.). Generative AI in the classroom: From hype to reality? In *one.oecd.org/*. https://one.oecd.org/document/EDU/EDPC(2023)11/en/pdf

Pappas, M. A., & Drigas, A. (2016). Incorporation of Artificial Intelligence Tutoring Techniques in Mathematics. *International Journal of Engineering Pedagogy (IJEP)*, *6*(4), 12. https://doi.org/10.3991/ijep.v6i4.6063

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Schnoberg, C. (2002). *The Impact of IXL on ACT English and ACT Reading Performance in Tennessee. Research Report.* https://www.ixl.com/materials/us/research/The_Impact_of_IXL_in_Tennessee.pdf

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, *99*(6), 323-338. https://doi.org/10.3200/JOER.99.6.323-338

Sinha, P., Calfee, C. S., & Delucchi, K. (2020). Practitioner's Guide to Latent class Analysis: Methodological considerations and common pitfalls. *Critical Care Medicine*, *49*(1), e63–e79. https://doi.org/10.1097/ccm.0000000000004710

Sukendro, S., Habibi, A., Khaeruddin, K., Indrayana, B., Syahruddin, S., Makadada, F. A., & Hakim, H. (2020). Using an extended Technology Acceptance Model to understand students' use of e-learning during Covid-19: Indonesian sport science education context. *Heliyon*, *6*(11), e05410. https://doi.org/10.1016/j.heliyon.2020.e05410

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Thurm, D. (2018). Teacher Beliefs and Practice When Teaching with Technology: A Latent Profile Analysis. In *ICME-13 monographs* (pp. 409–419). https://doi.org/10.1007/978-3-319-76575-4_25

UNESCO. (2021). *AI and education: guidance for policymakers* [Online]. United Nations Educational, Scientific and Cultural Organization. https://discovery.ucl.ac.uk/id/eprint/10130180/1/Miao%20and%20Holmes%20-%202021%20-%20AI%20and%20education%20guidance%20for%20policy-makers.pdf

UNESCO, & Fengchun, M. (2023). *Guidance for generative AI in education and research*. https://unesdoc.unesco.org/ark:/48223/pf0000386693

Uygun, D. (2024). Teachers' perspectives on artificial intelligence in education. *Advances in Mobile Learning Educational Research*, *4*(1), 931–939. https://doi.org/10.25082/amler.2024.01.005

Ross, A., & Willson, V. L. (2018). *Basic and advanced statistical tests: Writing Results Sections and Creating Tables and Figures*. Springer.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540

Visser, P. S., Krosnick, J. A., & Lavrakas, P. J. (2000). Survey research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 223–252). Cambridge University Press.

Vrieze, S. (2012). Model selection and psychological theory: A discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). *Psychological Methods*, *17*(2), 228–243. https://doi.org/10.1037/a0027127

Wang, Y., Liu, C., & Tu, Y.-F. (2021). Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling. *Educational Technology & Society*, *24*(3), 116–129. https://www.jstor.org/stable/27032860

Weng, F., Yang, R., Ho, H., & Su, H. (2018b). A TAM-Based Study of the Attitude towards Use Intention of Multimedia among School Teachers. *Applied System Innovation*, *1*(3), 36. https://doi.org/10.3390/asi1030036

Yang, S. J. H. (2021). Guest Editorial: Precision Education - A New Challenge for AI in Education. *Educational Technology & Society*, *24*(1), 105–108. https://www.jstor.org/stable/26977860

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019, December 1). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1). https://doi.org/10.1186/s41239-019-0171-0

Zhang, C., Schießl, J., Plößl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among pre-service teachers: a multigroup analysis. *International Journal of Educational Technology in Higher Education*, *20*(1). https://doi.org/10.1186/s41239-023-00420-7

Šabić, J., Baranović, B., & Rogošić, S. (2021). Teachers' Self-efficacy for Using Information and Communication Technology: The interaction Effect of Gender and Age. *Informatics in Education (Spausdinta)*. https://doi.org/10.15388/infedu.2022.11

Appendices

Teachers' Attitudes Toward Artificial Intelligence in Education in Kazakhstan
Appendix A – Declaration of the Use of Generative AI

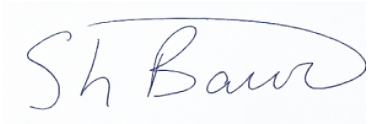
I hereby declare that I have read and understood NUGSE's policy concerning appropriate use of AI and composed this work independently (please check one):

☐ with the use of artificial intelligence tools, or
☒ without the use of artificial intelligence tools.

(If you have used AI tools as defined in the GSE policy document, please complete the rest of this form.)

During the preparation of this thesis/examination, I used _____ [NAME of TOOL] to _____ [REASON][4].

I also declare that I
☐ am aware of the capabilities and limitations of AI tool(s),
☐ have verified that the content generated by AI systems and adopted by me is factually correct,
☐ am aware that as the author of this thesis I bear full responsibility for the statements and assertions made in it,
☐ have submitted complete and accurate information about my use of AI tools in this work, and
☐ acknowledge that there may be disciplinary consequences if I have not followed NUGSE's guidelines regarding AI appropriate use.

Name: Baurzhan Shaikhin Signature: 
Date: 20.04.24

[4] Examples of REASON: brainstorm ideas / find or select sources on a topic / paraphrase / structure and organize the written text / edit the text for clarity and grammar / ask for tips to improve coherence / cite and reference sources

Appendix B

Site Access Request Letter (English)

[Date: 24.11.2023]

Teachers' attitudes toward artificial intelligence in education

Dear School Administrator,

My name is Baurzhan Shaikhin. I am a MSc Educational Leadership master's student at Nazarbayev University and I am conducting a study to explore teachers' attitudes toward AI in education in Astana, Kazakhstan. Also, it will investigate the relationship between attitudes and various factors, such as age, gender, teaching experience, subject group taught, subjective norms, computer self-efficacy, and facilitating conditions.

In this research project, I am requesting permission to access your school to data from teachers at your institution. More specifically, we would like teachers at your school to complete a brief survey questionnaire to explore teachers' attitudes toward using AI in education.

Nazarbayev University requires that we obtain written consent from you, giving your approval for us to conduct this research at your institution. If you grant permission for us to proceed with this research, we would ask you to share a brief questionnaire with the teachers of your institution.

This research has been approved by the GSE Institutional Research Ethics Committee Sub-Committee Committee.

What you need to know about the research process?

- The name of your university will not appear in any report produced within this project.
- Participation in this study is strictly voluntary.
- Participants can change their mind and choose not to participate in the research at any time.
- If a participants decides to withdraw from the study any information a person has contributed will be deleted, up until the project has been published.
- The contribution of participants will be strictly confidential.
- The data will not be supplied to any other person outside of the research team.
- The data from this project will be stored securely at password protected computers, and/or locked cabinet at Nazarbayev University.
- The data will be stored for a minimum period of 3 years, after which it will be destroyed.

If you would like more information, please contact Daniel Hernández-Torrano (Supervisor) on +77172709359 or by email: daniel.torrano@nu.edu.kz.

When you have had time to read this information sheet, please sign the consent below and email it back to me if you are willing to allow us to conduct this research in your institution. Please indicate who we should contact for all future communication about this research project.

Yours sincerely,

Baurzhan Shaikhin

Site access consent:

I, _____

[name of the Principal], Principal of

_____ [name of the school],

grant permission to Baurzhan Shaikhin to conduct the study on mental health and help-seeking behaviors of university students in Kazakhstan under the conditions indicated in this information sheet.

Signature: _____ Date:

_____

Contact details of the responsible person for all communication about this research project:

Name: _____

Position: _____

Phone number: _____

Email: _____

Appendix C

Site Access Request Letter (Kazakh)

[Күні: 24.11.2023]

Мұғалімдердің білім берудегі жасанды интеллектке (ЖИ) көзқарастары

Құрметті мектеп әкімшілігі,

Менің атым Бауыржан Шайхин. Мен Назарбаев Университетінде білім беру көшбасшылығы бойынша магистратураның (GSE) магистрантымын және Астанадағы, Қазақстандағы білім берудегі ЖИ-ке мұғалімдердің көзқарасын зерттеу мақсатында зерттеу жүргізіп жатырмын. Сондай-ақ, жас, жыныс, педагогикалық тәжірибе, оқытылатын пәндік топ, субъективті нормалар, компьютердің өзіндік тиімділігі және жеңілдететін жағдайлар сияқты көзқарастар мен әртүрлі факторлар арасындағы байланысты зерттейтін болады.

Осы зерттеу жобасында мен сіздің мектебіңіздегі мұғалімдердің деректеріне қол жеткізуге рұқсат сұраймын. Нақтырақ айтқанда, сіздің мектебіңіздің мұғалімдері мұғалімдердің білім беруде ЖИ-ті қолдануға деген көзқарасын зерттеу үшін қысқаша сауалнаманы толтырғанын қалаймыз.

Назарбаев Университеті бұл зерттеуді сіздің мекемеңізде жүргізуге рұқсат бере отырып, сізден жазбаша келісім алуымызды талап етеді. Егер сіз бізге осы зерттеуді жалғастыруға рұқсат берсеңіз, сізден мекемеңіздің оқытушыларымен қысқаша сауалнаманы бөлісуіңізді сұраймыз.

Бұл зерттеуді GSE институттық зерттеу этикасы комитетінің қосалқы комитеті мақұлдады.

Зерттеу процесі туралы не білу керек?

• Сіздің мектебіңіздің аты осы жоба аясында жасалған ешбір есепте көрсетілмейді.
• Бұл зерттеуге қатысу ерікті.
• Қатысушылар өз ойын өзгертіп, кез келген уақытта зерттеуге қатыспауды таңдай алады.
• Қатысушылар зерттеуден бас тартуды шешсе, жоба жарияланғанға дейін адам қосқан кез келген ақпарат жойылады.
• Қатысушылардың қосқан үлесі қатаң түрде құпия болады.
• Деректер зерттеу тобынан тыс кез келген басқа адамға берілмейді.
• Бұл жобаның деректері құпия сөзбен қорғалған компьютерлерде және/немесе Назарбаев Университетіндегі құлыпталған шкафта қауіпсіз сақталады.
• Деректер кем дегенде 3 жыл сақталады, содан кейін жойылады.

Қосымша ақпарат алғыңыз келсе, Дэниел Эрнандес-Торраноға (Жетекші) +77172709359 немесе daniel.torrano@nu.edu.kz электрондық поштасы арқылы хабарласыңыз.

Осы ақпарат парағын оқуға уақытыңыз болған кезде, төмендегі келісімге қол қойып, осы зерттеуді өз мекемеңізде жүргізуге рұқсат бергіңіз келсе, оны маған электрондық пошта арқылы жіберіңіз. Осы зерттеу жобасы туралы болашақта хабарлау үшін кімге хабарласу керектігін көрсетіңіз.

Сізге шын берілген,

Бауыржан Шайхи
Мектепке кіруге рұқсат:

Мен, _____
[директордың аты-жөні], _____
[мектептің атауы] директоры, Бауыржан Шайхинге осы ақпараттық парақта көрсетілген шарттарда мұғалімдердің білім берудегі жасанды интеллектке деген көзқарасы туралы зерттеу жүргізуге рұқсат беремін.

Қолы: _____ Күні: _____

Осы зерттеу жобасы туралы барлық хабарлау үшін жауапты тұлғаның байланыс деректері:

Аты-жөні: _____

Лауазымы: _____

Телефон нөмірі: _____

Электрондық пошта: _____

Appendix D

Site Access Request Letter (Russian)

[Дата: 24.11.2023 г.]

Отношение учителей к искусственному интеллекту (ИИ) в образовании

Уважаемый администратор школы,

Меня зовут Бауржан Шайхин. Я учусь на магистратуре по направлению «Лидерство в образовании» Назарбаев Университета и провожу исследование с целью изучить отношение учителей к ИИ в образовании в Астане, Казахстан. Кроме того, я буду исследовать взаимосвязь между отношениями и различными факторами, такими как возраст, пол, опыт преподавания, преподаваемая предметная группа, субъективные нормы, компьютерная самодостаточность и способствующие условия.

В этом исследовательском проекте я запрашиваю разрешение на доступ вашей школы к данным учителей вашего учреждения. В частности, мы хотели бы, чтобы учителя вашей школы заполнили краткую анкету, чтобы изучить отношение учителей к использованию ИИ в образовании.

Назарбаев Университет требует, чтобы мы получили от вас письменное согласие, дающее согласие на проведение данного исследования в вашем учреждении. Если вы дадите нам разрешение продолжить это исследование, мы попросим вас поделиться краткой анкетой с преподавателями вашего учебного заведения.

Это исследование было одобрено Подкомитетом Комитета по этике институциональных исследований GSE.

Что нужно знать о процессе исследования?

• Название вашей школы не будет фигурировать ни в одном отчете, подготовленном в рамках этого проекта.
• Участие в этом исследовании строго добровольное.
• Участники могут передумать и отказаться от участия в исследовании в любое время.
• Если участник решит выйти из исследования, любая предоставленная им информация будет удалена до тех пор, пока проект не будет опубликован.
• Вклад участников будет строго конфиденциальным.
• Данные не будут предоставляться никому, кроме исследовательской группы.
• Данные этого проекта будут надежно храниться на компьютерах, защищенных паролем, и/или запертом кабинете в Назарбаев Университете.
• Данные будут храниться минимум 3 года, после чего будут уничтожены.

Если вам нужна дополнительная информация, свяжитесь с Даниэлем Эрнандес-Торрано (руководителем) по телефону +77172709359 или по электронной почте: daniel.torrano@nu.edu.kz.

Когда у вас будет время прочитать этот информационный лист, подпишите согласие ниже и отправьте его мне по электронной почте, если вы готовы разрешить нам провести это исследование в вашем учреждении. Пожалуйста, укажите, к кому нам следует обращаться для дальнейшего общения по поводу этого исследовательского проекта.

Искренне Ваш,

Бауржан Шайхин

Согласие на доступ в школу:

Я, _____ _____ [имя директора], директор _____ [название школы], даю разрешение Бауржану Шайхину на проведение исследования по отношению учителей к искусственному интеллекту в образовании на условиях, указанных в настоящем информационном листе .

Дата подписания: _____

Контактные данные ответственного лица за всю информацию об этом исследовательском проекте:

Имя: _____

Позиция: _____

Номер телефона: _____

Электронная почта: _____

Appendix E

INFORMED CONSENT FORM
(for teacher participants)
Teachers' Attitudes Toward Artificial Intelligence in Education

DESCRIPTION:

You are invited to take part in a study on teachers' attitudes toward artificial intelligence in education. Your participation in this survey will help to better understand current teachers' attitudes toward artificial intelligence in education and contribute to the existing knowledge on factors affecting these attitudes. You will be asked to fill in a questionnaire about your attitudes toward artificial intelligence. Your anonymity will be protected since your real name or any information that would identify you as a participant will not be collected nor used in any research report derived from this study. Moreover, during the analysis process, only the supervisor and the researcher will have access to the data.

TIME INVOLVEMENT: Your participation will take approximately 10-15 minutes.

RISKS AND BENEFITS:
There are minimal risks to your personal and professional life from participating in this study. No research report derived from the analysis will include your name, e-mail address or IP address. The coding scheme that will be used to replace the participants' actual names will only be known by the researcher. All the data gathered for this study will be kept on the researcher's password-protected personal computer. A possible benefit is the opportunity to reflect on teaching practices through participation in the study. Participating in this survey will allow you to analyze your teaching practice, and perhaps will help you to further reveal your potential as a teacher, especially in the domain of appropriate artificial intelligence integration in teaching and learning. Participation in the study does not provide any rewards. Your decision whether to participate or not in this study will not affect your work in school.

PARTICIPANT'S RIGHTS:
Please be aware that your decision to engage in this project after reading this form is voluntary, and that you have the right to withdraw your consent.

The findings of this research project may be presented at conferences for professionals or scientists or documented in scholarly publications.

CONTACT INFORMATION:

Questions: If you have any questions, concerns or complaints about this research, its procedures, risks and benefits, contact the Master's Thesis Supervisor daniel.torrano@nu.edu.kz.

Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a
participant, please contact the NUGSE Research Committee at gse_researchcommittee@nu.edu.kz

Please choose the option below to participate or withdraw from the study.

I have read and understood the above consent form. I certify that I am 18 years old or older and, by clicking the next button to enter the survey, I indicate my willingness to voluntarily take part in the study.	☐ (route to survey page)
I do not wish to participate in this study.	☐ (route to final page)

Appendix F

INFORMED CONSENT FORM (Kazakh)
(for teacher participants)
Teachers' Attitudes Toward Artificial Intelligence in Education

АҚПАРАТТЫ КЕЛІСІМ ФОРМАСЫ
(мұғалім қатысушылары үшін)
Мұғалімдердің білім берудегі жасанды интеллектке көзқарасы

СИПАТТАМАСЫ: Сіздерді білім берудегі жасанды интеллектке мұғалімдердің көзқарасын зерттеуге қатысуға шақырамыз. Сіздің осы сауалнамаға қатысуыңыз мұғалімдердің білім берудегі жасанды интеллектке қатысты қазіргі көзқарасын жақсырақ түсінуге көмектеседі және осы көзқарастарға әсер ететін факторлар туралы бар білімге ықпал етеді. Сізден жасанды интеллект туралы көзқарастарыңыз туралы сауалнаманы толтыру сұралады. Сіздің құпиялылығыңыз қорғалады, өйткені сіздің нақты атыңыз немене басқа сізді анықтайтын ақпарат осы зерттеуден алынған ешбір зерттеу есебінде пайдаланылмайды. Сонымен қатар, талдау барысында деректерге тек жетекші мен зерттеуші ғана қол жеткізе алады.

УАҚЫТТЫ ҚҰРУ: Сіздің қатысуыңыз шамамен 10-15 минутты алады.

ТӘУЕКЕЛДЕР МЕН ПАЙДА: Бұл зерттеуге қатысудан сіздің жеке және кәсіби өміріңізге мейлінше аз ықпал етеді. Талдау нәтижесінде алынған ешбір зерттеу есебінде сіздің атыңыз, е-мэйл мекенжайыңыз, IP мекенжайыңыз болмайды. Қатысушылардың нақты есімдерін ауыстыру үшін қолданылатын кодтау схемасын зерттеуші ғана біледі. Осы зерттеу үшін жиналған барлық деректер зерттеушінің құпиясөзбен қорғалған дербес компьютерінде сақталады. Ықтимал артықшылық – зерттеуге қатысу арқылы оқыту тәжірибесі туралы ойлау мүмкіндігі.. Бұл сауалнамаға қатысу сіздің педагогикалық тәжірибеңіз туралы талдау жасауға мүмкіндік береді және мұғалім ретінде сіздің әлеуетіңізді анықтауға көмектеседі, әсіресе жасанды интеллекттің оқу процесіне сәйкес интеграциясы саласында. Зерттеуге қатысу ешқандай сыйақы бермейді. Бұл зерттеуге қатысу-қатыспау туралы шешіміңіз сіздің жұмысыңызға әсер етпейді.

ҚАТЫСУШЫНЫҢ ҚҰҚЫҚТАРЫ: Осы үлгіні оқығаннан кейін осы жобаға қатысу туралы шешіміңіз ерікті екенін және келісіміңізді қайтарып алуға құқығыңыз бар екенін ескеріңіз.
Бұл зерттеу жобасының нәтижелері мамандарға немесе ғалымдарға арналған конференцияларда ұсынылуы немесе ғылыми басылымдарда құжатталуы мүмкін.

БАЙЛАНЫС АҚПАРАТЫ:
Сұрақтар: Егер сізде осы зерттеуге қатысты сұрақтарыңыз, алаңдаушылығыңыз немесе шағымдарыңыз болса, оның процедуралар, тәуекелдер мен артықшылықтар бойынша магистрлік диссертация жетекшісіне daniel.torrano@nu.edu.kz хабарласыңыз.

Тәуелсіз байланыс: Егер сіз осы зерттеудің қалай жүргізіліп жатқанына қанағаттанбасаңыз немесе зерттеуге немесе сіздің құқықтарыңызға қатысты қандай да

бір алаңдаушылықтар, шағымдар немесе жалпы сұрақтарыңыз болса NUGSE зерттеу комитетіне gse_researchcommittee@nu.edu.kz хабарласыңыз.

Зерттеуге қатысу немесе оқудан шығу үшін төмендегі нұсқаны таңдаңыз.

Мен жоғарыда келтірілген келісім формасын оқып, түсіндім. Мен 18 жаста немесе одан үлкен екенімді растаймын және сауалнамаға кіру үшін келесі түймені басу арқылы зерттеуге өз еркіммен қатысуға дайын екенімді білдіремін.	(сауалнама бетіне өту)
Мен бұл зерттеуге қатысқым келмейді	(соңғы бетке өту)

Appendix G

INFORMED CONSENT FORM (Russian)
(for teacher participants)
Teachers' Attitudes Toward Artificial Intelligence in Education

ФОРМА ИНФОРМИРОВАННОГО СОГЛАСИЯ
(для участников-учителей)

Отношение учителей к искусственному интеллекту в образовании

ОПИСАНИЕ:
Вас приглашают принять участие в исследовании отношения учителей к искусственному интеллекту в образовании. Ваше участие в этом опросе поможет лучше понять текущее отношение учителей к искусственному интеллекту в образовании и внести вклад в существующие знания о факторах, влияющих на эти отношения. Вам будет предложено заполнить анкету о вашем отношении к искусственному интеллекту. Ваша анонимность будет защищена, так как ваше настоящее имя или какая-либо другая информация, раскрывающая вашу личность, не будет использоваться в каких-либо исследовательских отчетах, полученных из этого исследования. Кроме того, в процессе анализа доступ к данным будет иметь только руководитель и исследователь.
ВРЕМЯ УЧАСТИЯ: Ваше участие займет около 10-15 минут.
РИСКИ И ПРЕИМУЩЕСТВА: Участие в этом исследовании сопряжено с минимальным риском для вашей личной и профессиональной жизни. Ни в одном исследовательском отчете, полученном в результате анализа, не будет указано ваше имя, е-мэйл, IP адрес. Схема кодирования, которая будет использоваться для замены настоящих имен участников, будет известна только исследователю. Все данные, собранные для этого исследования, будут храниться на персональном компьютере исследователя, защищенном паролем. Возможным преимуществом является возможность поразмышлять над практикой преподавания посредством участия в исследовании. Участие в этом исследовании позволит вам проанализировать вашу педагогическую практику и, возможно, поможет выявить ваш потенциал как учителя, особенно в области подходящей интеграции искусственного интеллекта в образовательный процесс. Участие в исследовании не предусматривает никаких вознаграждений. Ваше решение участвовать или нет в этом исследовании не повлияет на вашу работу в школа.

ПРАВА УЧАСТНИКА: Имейте в виду, что ваше решение участвовать в этом проекте после прочтения этой формы является добровольным, и что вы имеете право отозвать свое согласие.

Результаты этого исследовательского проекта могут быть представлены на конференциях для профессионалов или ученых или задокументированы в научных публикациях.

КОНТАКТЫ: Вопросы: Если у вас есть какие-либо вопросы, опасения или жалобы по поводу этого исследования, его процедуры, риски и преимущества, свяжитесь с научным руководителем магистерской работы daniel.torrano@nu.edu.kz.

Независимый контакт: если вы не удовлетворены тем, как проводится это исследование, или если у вас есть какие-либо опасения, жалобы или общие вопросы об исследовании или ваших правах как участник, пожалуйста, свяжитесь с Исследовательским комитетом NUGSE по адресу gse_researchcommittee@nu.edu.kz.

Пожалуйста, выберите вариант ниже, чтобы принять участие или выйти из исследования.

Я прочитал и понял приведенную выше форму согласия. Я подтверждаю, что мне 18 год или больше, и, нажимая кнопку «Далее» для участия в опросе, я выражаю свою готовность добровольно принять участие в исследовании.	(переход на страницу опроса)
Я не хочу участвовать в этом исследовании	(переход к последней странице)

Appendix H

Questionnaire on Teachers' Attitudes Toward Artificial Intelligence in Education

The version of the survey in English:
https://docs.google.com/forms/d/1DzSOIpNhhr9QXFw8VDFvdQ68inXjqXvp1wBIKnphITs/edit#settings

The version of the survey in Kazakh:
https://docs.google.com/forms/d/1ASck9KuvWUQjtUgcdWZS1m-oW__wm4bg-0TY9qFRC2U/edit

The version of the survey in Russian:
https://docs.google.com/forms/d/1Zkd18d-xC4dgrhrpZshSsRjVo9jIoQwqjHiVg5gd3KI/viewform?edit_requested=true