TEACHERS' EXPERIENCE with ADAPTIVE LEARNING in GIFTED EDUCATION: A QUALITATIVE CASE STUDY in SCHOOLS for GIFTED STUDENTS in KAZAKHSTAN

SALTANAT MUKHAMADIYEVA

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Date: 26 of October, 2022

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Saltanat Mukhamadiyeva

This letter now confirms that your research project titled

Teachers' experience with adaptive learning in gifted education: a qualitative case study in schools for gifted students in Kazakhstan

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

You may proceed with contacting your preferred research site and commencing your participant recruitment strategy.

Yours sincerely,

Daniel Hernández-Torrano, PhD
Associate Professor

On behalf of:
Dr Matthew Courtney, *PhD*
Chair, GSE Ethics Committee
Graduate School of Education
Nazarbayev University

Block C3, Room M027
Office: +7 (7172) 70 6659
Mobile: +7 708 274 9564
email: matthew.courtney@nu.edu.kz, gse.irec@nu.edu.kz

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ABSTRACT

TEACHERS' EXPERIENCE with ADAPTIVE LEARNING in GIFTED EDUCATION: A QUALITATIVE CASE STUDY in SCHOOLS for GIFTED STUDENTS in KAZAKHSTAN

Adaptive learning personalizes instructions to each student's unique learning needs. Adaptive learning has shown a positive impact on students' achievement in developed countries like China and the USA (Wang et al, 2020). However, research on these models is scarce, particularly on Kazakhstani teachers' experiences. Insufficient research has been conducted on the design and implementation of adaptive learning technologies in Kazakhstan. To address this gap, this qualitative multiple case study was conducted to explore the experiences and perspectives of Kazakhstani teachers who participated in a pilot of adaptive learning technology in gifted education. The study employed a framework based on More Knowledgeable Other (MKO) and the (Technological Pedagogical Content Knowledge) TPCK theories as a lens to guide data collection and analysis. This qualitative case study provides light into the experiences and perspectives of Kazakhstani teachers who participated in a pilot of adaptive learning technology in gifted education. The findings of the study could provide insights into how adaptive learning technology can be effectively designed and implemented in Kazakhstani schools, particularly in the context of gifted education. The study also contributes to developing the TPCK framework by providing empirical evidence of its applicability in a different cultural context. Overall, this study could have significant implications for improving teaching and learning practices in Kazakhstan and beyond.

Keywords: Adaptive learning, personalization, gifted education, artificial intelligence.

Аңдатпа

ОҚЫТУШЫЛАРДЫҢ ДАРЫНДЫ БІЛІМ БЕРУДЕГІ БЕЙІМДІ ОҚУ ТӘЖІРИБЕСІ: ҚАЗАҚСТАНДАҒЫ ДАРЫНДЫ ОҚУШЫЛАРҒА АРНАЛҒАН МЕКТЕПТЕРДЕГІ САПАЛЫ СТУДИЯ.

Бейімді оқыту әрбір оқушының бірегей оқу қажеттіліктеріне нұсқауларды жекелендіреді. Бейімді оқыту Қытай мен АҚШ сияқты дамыған елдерде оқушылардың жетістіктеріне оң әсер етті (Wang et al, 2020), алайда бұл модельдер бойынша зерттеулер, әсіресе Қазақстандық мұғалімдердің тәжірибесі бойынша аз. Қазақстанда бейімделген оқыту технологияларын жобалау және енгізу бойынша зерттеулер жеткіліксіз жүргізілген. Осы олқылықты жою үшін дарынды білім берудегі бейімді оқыту технологиясының пилоттық нұсқасына қатысқан қазақстандық мұғалімдердің тәжірибелері мен перспективаларын зерттеу үшін осы сапалы бірнеше жағдайлық зерттеу жүргізілді. Зерттеу мәліметтерді жинау мен талдауды бағыттау объектісі ретінде Көбірек білімді басқа (МКО) және (Технологиялық педагогикалық мазмұнды білу) TPCK теорияларына негізделген құрылымды пайдаланды. Бұл сапалы кейс-стади дарынды білім берудегі бейімді оқыту технологиясының пилоттық нұсқасына қатысқан қазақстандық мұғалімдердің тәжірибесі мен перспективаларын көрсету үшін жасалды. Зерттеудің нәтижелері бейімді оқыту технологиясын қазақстандық мектептерде, әсіресе дарынды білім беру контекстінде қалай тиімді құрастыруға және енгізуге болатыны туралы түсінік бере алады. Зерттеу сонымен қатар оның басқа мәдени контексте қолданылуының эмпирикалық дәлелдерін ұсыну арқылы TPCK құрылымын дамытуға үлес қоса алады. Тұтастай алғанда, бұл зерттеу Қазақстанда және одан тыс жерлерде оқыту мен оқу тәжірибесін жақсартуға елеулі әсер етуі мүмкін.

Кілт сөздер: Бейімді оқыту, жекелендіру, дарынды білім беру, жасанды интеллект.

Аннотация

Адаптивное обучение персонализирует инструкции в соответствии с уникальными учебными потребностями каждого учащегося. Адаптивное обучение оказало положительное влияние на успеваемость учащихся в таких развитых странах, как Китай и США (Wang et al, 2020), однако исследований по этим моделям мало, особенно в отношении опыта казахстанских учителей. Недостаточно исследований по разработке и внедрению адаптивных технологий обучения в Казахстане. Чтобы устранить этот пробел, было проведено это качественное множественное тематическое исследование для изучения опыта и взглядов казахстанских учителей, которые участвовали в пилотном проекте адаптивной технологии обучения в обучении одаренных. В исследовании использовалась структура, основанная на теориях «Более знающие другие» (MKO) и (Знание технологического педагогического содержания) TPCK в качестве линзы для руководства сбором и анализом данных. Это качественное тематическое исследование было проведено, чтобы пролить свет на опыт и взгляды казахстанских учителей, которые участвовали в пилотном проекте адаптивной технологии обучения в обучении одаренных. Результаты исследования могут дать представление о том, как можно эффективно разработать и внедрить технологию адаптивного обучения в казахстанских школах, особенно в контексте обучения одаренных детей. Исследование также могло бы способствовать развитию структуры TPCK, предоставив эмпирические доказательства ее применимости в другом культурном контексте. В целом, это исследование может иметь значительные последствия для улучшения практики преподавания и обучения в Казахстане и за его пределами.

Ключевые слова: адаптивное обучение, персонализация, одаренное образование, искусственный интеллект.

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1. Introduction

This study aims to explore teachers' experiences using adaptive learning approaches in gifted education in Kazakhstan schools. This study employs a qualitative case study methodology to illustrate the phenomenon under examination and includes 7-10 purposefully selected teacher participants who have worked and/or working on an adaptive learning pilot project in gifted education. The results from this study fill a gap in the literature and may aid policymakers and school administrators in evaluating and enhancing teachers' experiences in gifted education.

In the first section of this chapter, I present the background information about the current research phenomenon, as it is a relatively new global teaching approach and is being first implemented in Kazakhstani gifted education. In the next section, I discuss the unique features of gifted education in Kazakhstan. This is important for my study as it can help readers focus on and understand the topic. Following this, the problem statement, the statement of purpose, and posed research questions are presented. The chapter concludes with a discussion of the proposed rationale and significance of this research study and the definition of some of the key terminology used.

1.1 Context Information: Gifted Education, Personalized Education, and Adaptive Learning

Promoting equity and excellence at all levels of education is a top priority for all educational systems to ensure that all children have opportunities for success. Equity, connected to the concept of fairness, means that personal or socio-economic conditions such as ability, gender, ethnic origin, or family origin do not hinder the success of education. Fostering excellence, on the other hand, implies striving to provide quality education tailored

to the different talents and needs of all students, striving to enable each of them to reach their potential (Brusoni et al., 2014; Peters & Engerrand, 2016; Reis, Renzulli & Renzulli, 2021).

Both principles are desirable, possible, and compatible (Schleicher, 2014). However, only a few education systems around are capable of achieving both objectives simultaneously to satisfactory levels (Peters & Engerrand, 2016). As a result, the number of students who fully benefit from compulsory education is limited. This is especially true for gifted and talented students, whose classroom experiences are usually focused on topics they have already mastered (Letina, 2021; Pfeiffer, 2012) and too often do not have access to quality opportunities to maximize their learning (Little, 2012; Reis, Renzulli & Renzulli, 2021).

A considerable number of models and approaches have been proposed to promote academic and non-academic outcomes of gifted students. For example, according to Kelemen (2010), there are a range of strategies that are well-suited to meet the needs of gifted and talented students. These may involve enriching the curriculum, speeding up the pace of learning, admitting students to school at an earlier age, skipping a grade level, offering specialized classes, organizing students into groups based on their level of academic ability, encouraging self-directed learning, adopting a grading system that doesn't rely on traditional grades, condensing the curriculum, accelerating the pace of learning, using a credit-based system to measure progress, and providing opportunities for extracurricular activities. Recent research on education for gifted students confirms the significance of using accelerated approaches and enrichment-based teaching methods that offer suitably challenging, meaningful, and applicable learning opportunities for students with advanced abilities (Ritochotte et al., 2014). According to experts in the field of gifted education, specialists need to advocate for cohesive educational practices comprised of a curriculum that incorporates

students' personal interests and is rigorous enough to promote the development of their outstanding intellectual ability (e.g., Stott & Hobden, 2016). In general, suitable adaptations for gifted students often include adjusting the tempo, selecting an appropriate level of effort, and offering chances for supported interest development (Tomlinson, 2005).

Among these approaches, personalized learning is increasingly considered the cornerstone to guaranteeing that gifted and advanced children obtain the quality of education that has escaped far too many of them for far too long (Kettler & Taliaferro, 2022). The necessity for a personalized approach that gives students greater choice and control over their own learning is recognised by current trends in gifted education (Bray & McClaskey, 2015; Clarke, 2013; Netcoh 2017). The term "personalized learning" has been used to describe various instructional strategies that seek to address the distinctive qualities of each student in the classroom (Bingham et al., 2018; Netcoh, 2017). Kettler and Taliaferro (2022) describe a vision of personalized learning based on the best understanding educational theorists have developed to explain how children learn and build meaning. This vision is comprised of five fundamental characteristics backed by research on gifted education: (1) personalized talent development plans; (2) competency-based progressions and accelerations; (3) inquiry models of learning; (4) criterion-referenced assessment of students progress, and (5) multi-year mentoring for talented development (p 17). Due to the fact that both intelligence and giftedness are multidimensional phenomena, and our environment is always changing, programs and courses for gifted students must likewise be multidimensional and complex (Maker, 2005), and the curricula must be reviewed regularly.

The advancement of technology, such as Google classroom, Renzulli Learning, and Adaptive learning systems (e.g., ALEKS, CogBooks, CANVAS) in the 21st century created

various opportunities to ensure gifted learners' personalized learning, particularly through the study of pupils' learning to better serve individualized growth. Rather than additional learning material, these personalized approaches to learning promote a range of learning experiences addressing student learning needs. This incorporation of technology to personalized learning environments has produced a new development path: technology-enabled personalized learning (Peng et al., 2019; Shemshack & Spector, 2020). To personalize learning for each student, a technology-enhanced approach known as adaptive learning has been developed, which uses interactive teaching devices and allocates resources based on the unique needs of each individual (Dutton, 2018).

Adaptive learning is considered a strategy for delivering personalized learning in order to provide each student with efficient, effective, engaging, and individualized learning routes (Harati et al., 2021). The benefit of adaptive learning is that the system provides the student with tailored learning opportunities adjusted to their performance in the previous session. This approach allows the learners to skip information if they are already acquainted with it, and judge it as too simple or too difficult, which positively impacts the individual's educational trajectory (Ordov et al., 2019). In education, adaptive instruction aims to give what has long been the greatest aim of pedagogy: personalized compassionate assistance for each pupil (Kolchenko, 2018). George and Lal (as cited in Shemshack & Spector, 2020) argued that personalized learning is intended to incorporate a learner's diverse traits, such as learning style, knowledge level on a subject, preferences, and prior knowledge, whereas adaptive learning is the process of modifying content to the learner's preferences and speed. Each adaptive learning system has its own algorithm for personalizing the learning content to students’ characteristics and needs (Alamri et al., 2020).

Personalized and adaptive learning have always been the primary objectives of smart learning environments (Peng et al., 2019). Hwang et al. (as cited in Peng et al., 2019) defined smart learning environments as learning environments or activity venues that facilitate successful learning. In this regard, the evolution of contemporary technology has made personalized learning more adaptive and adaptive learning more personalized (Peng et al., 2019).

Adaptive learning and personalized learning are similar concepts, but they have some key differences. Adaptive learning is the use of technology to modify the lesson's content, speed, and difficulty depending on a student's performance. The purpose is to assist students learn more successfully by adapting the content to their present level of comprehension. Personalized learning, on the other hand, is a larger strategy that entails customizing each student's complete learning experience. This includes not just the lesson's content and timing, but also the instructional approach, the use of technology, and the evaluation and feedback offered. Students' interests and passions may be used to inspire and involve them in their study as part of personalized instruction. Briefly, adaptive learning is a technology that may be used to promote personalized learning, while personalized learning comprises a broader variety of strategies for individualizing student education.

1.2 Background Information: Learning Opportunities for Gifted Students

Kazakhstan, the most populous and fastest-growing country in Central Asia, inherited a Soviet education system with a distinct approach to and interest in gifted education that reflects many of the characteristics of the talented child paradigm (Almukhambetova & Hernández-Torrano, 2020). These include a conception of giftedness based on high intelligence and performance, an identification system based on achievement and performance-based measures, a segregated education system with specialized schools

offering advanced curricula in particular strength areas, and an emphasis on creating an intellectual elite and advancing social and economic welfare (Almukhambetova & Hernández-Torrano, 2020).

To make education a more effective instrument for developing the country's human capital and enhancing competitiveness, Kazakhstan has put much emphasis on the establishment of elite institutions for gifted and talented students, such as the Nazarbayev Intellectual Schools (NIS) and Nazarbayev University (NU) (Yakavets, 2014). NIS is a network of 20 intellectual schools and two International Baccalaureate (IB) schools which was founded to promote innovative practices as well as to share its knowledge with mainstream schools (Nurkesheva, 2015).

NIS schools utilize a new worldwide curriculum and are primarily designed for gifted or high-achieving pupils (Makoelle, 2020). On the basis of competition, NIS schools admit the most talented and academically driven students. These students not only perform well in school courses, but also display greater academic English abilities and intentions to study overseas after graduation (Kuzhabekova, Soltanbekova & Almukhambetova, 2018).

Contests and academic Olympiads are also highly appreciated in Kazakhstan. In order to effectively prepare NIS students for subject Olympiads at various levels, training camps are held with the involvement of experienced trainers, including graduates of the Intellectual Schools who are former winners and prize-winners of republican and international Olympiads (NIS, 2022).

"In order to attract highly qualified specialists in education and university graduates with a high level of academic and language knowledge, the procedures for attracting and recruiting employees are annually aligned with the requirements of external market and optimised based on the analysis of internal recruitment needs (NIS, 2021, p.23). In order to

attract foreign staff, NIS collaborates with international recruiting companies in the long term (NIS, 2021).

NIS represents in many ways a parallel system for the introduction of educational reform, in that it seeks out "best practices" from around the globe, including the Russian Federation, Estonia, the United Kingdom, the United States of America, the Netherlands, Singapore, Switzerland, and others (Yakavets, 2014). More specifically, NIS engages in strategic collaborations with major worldwide educational providers, such as the International Baccalaureate from Switzerland; examples of educational initiatives include the implementation of fresh curriculum and assessment methods by Cambridge International Examinations and the Central Institute for Test Development (CITO) in the Netherlands, talent development approaches from the Johns Hopkins Center for Talented Youth in the United States, and trilingualism strategies from Estonia and Quebec; and approaches to pre-school education from New Zealand and Italy, only to mention a few (Bridges, Kurakbayev & Kambatyrova, 2014).

NIS has recently adopted personalized learning as a means of fostering student involvement in learning and boosting student achievement (NIS, 2020b). Two models of personalized learning have been practiced in the NIS schools up to date: "Accelerated Learning" (a program of 8-10 grades in 2 years, hereinafter referred to as Model 1) and "Individual Educational Route" (hereinafter referred to as Model 2) (NIS, 2020b). In accordance with the NIS 2030 Development Strategy's objective to "increase Kazakhstan's intellectual capacity through the integration of the best national and international practices and significant scientific advances in the field of school education," the NIS has been integrating the best international experience into the educational process (NIS, 2020a).

In January 2022, NIS started a collaboration with McGrawHill (USA) and Cambridge University (UK) in implementing adaptive learning in gifted education. Introducing adaptive

learning solutions allows the implementation of e-learning that combines student learning with enhanced academic performance via the development, management, and use of technology processes and resources (NIS, 2020a). NIS examined the worldwide experience with adaptive learning systems and analyzed 22 platforms (e.g., ALEKS, Knewton, Domoscio, SmartSparrow, Dreambox) utilized in 10 nations (NIS, 2020a).

1.3 Problem Statement

While the Kazakhstani government has enacted several educational changes to assist gifted students, little attention has been paid to teachers' experiences. There are always challenges with new educational endeavors, and instructors are the first to face them. Teachers might encounter displeasure if they see that children are not showing progress, or might need support in adaptive learning teaching approaches. Depending on their background, teachers may have their own strategies, and it is crucial that they share their experiences with other educators.

Nazarbayev Intellectual Schools introduced personalized learning for gifted students in 2019. (NIS, 2020b). Some research has recently been conducted by NIS administration to understand the implementation of personalized learning at NIS schools. The research mainly focused on exploring the understanding of personalized learning by teachers, students, and their parents. Based on the results of this study, recommendations were made to improve personalized learning in NIS schools in the next academic year (NIS, 2020b). The findings also indicate that students held wrong expectations from this learning model (e.g., learners mistakenly thought that by studying on the Individual Educational Route, they would be able to finish school earlier) (NIS, 2020b). However, the research did not fully examine teachers' experiences with personalized learning. Although preliminary findings suggest that teachers report positive features of personalized learning in connection to student progress, little attention has been paid to the challenges and opportunities that teachers encounter in

teaching, curriculum design, or using technology. Meanwhile, the ways in how teachers experience the implementation of personalized learning are of great importance since “their beliefs and practices could have the greatest impact on the learning experiences of their students” (Davis & Andrzejevski, as cited in Xu, 2012).

However, “piloting and implementation of personalized learning is an intermediate stage in the transition to adaptive learning across the Intellectual schools” (NIS, 2020a, p. 52). Adaptive learning has arisen as a technology-enhanced personalized approach to learning that incorporates interactive teaching devices and resources according to the specific requirements of each student. Rationale for conducting this study is the dearth of research on adaptive learning in gifted education in secondary schools. Xie, Chu, Hwang, and Wang (as cited in Alamri et al., 2021) conducted review of the literature of the trends and direction of the personalized learning/adaptive learning research between 2007 and 2017 and concluded that most selected learners for implementing personalized/adaptive learning systems were in higher education (p. 65). To my knowledge, no studies have been undertaken on teachers' adaptive learning experiences in gifted secondary education. Studies which show the teachers’ experiences with adaptive learning in gifted education are not generally published.

All in all, although choices to implement an adaptive learning strategy are often made by an institution's administrators, it is extremely improbable that a good result would occur without teachers' support. Teachers are in a unique position to promote innovation in gifted education; hence, knowing their experiences may contribute to the literature, inform best practices, and influence the future use of adaptive learning technologies in gifted education. It is recommended by the Implementing guide (Taylor, Yeung & Bashet, 2021) to include teachers early in the process alongside institution-wide participation to increase the likelihood of a successful result. It's as simple and as complicated as saying that educational reform relies on what instructors do and think (Fullan, 2001).

1.4 Research Purpose and Questions

The purpose of this study is to examine and describe Kazakhstani teachers' experiences with adaptive learning approaches in gifted education. Drawing on empirical data and associated literature, this study intends to examine how Kazakhstani teachers conceptualize adaptive learning, what their experience with the approach has been, and how they go about implementing it. By examining teachers' experiences, I aim to discover the obstacles they confront, the teaching strategies they find effective, the opportunities adaptive learning systems offer, as well as the limitations of adaptive learning.

This study will be conducted in four intellectual schools for gifted children in Ust-Kamenogorsk, Taldykorgan, Shymkent and Nur-Sultan cities, as they piloted adaptive learning systems ALEKS (for Chemistry) and CogBooks (for Physics and Biology) recently. The rationale for selecting these schools is that they are: 1) intellectual schools; 2) they are one of the few schools that have piloted personalized adaptive learning; 3) they are located in different parts of Kazakhstan - East, South-East, South, and North, maximizing the diversity of teachers' experiences; and 4) gatekeepers and participants have preliminarily agreed to participate in the study. The population of this study is teachers who have experience in teaching gifted students in adaptive learning. In total, the number of participants in this study comprises 8 teachers.

The following questions will be addressed in this study:

RQ1: How do NIS teachers conceptualize adaptive learning in gifted education?

RQ2: What are NIS teachers' experiences with adaptive learning in gifted education?

RQ3: How do NIS teachers approach the implementation of adaptive learning in gifted education?

1.5 Significance of the Study

The selected topic is relevant to the current national educational agenda in Kazakhstan, and it can support practitioners in designing and executing effective gifted

education programs. Overall, the findings of the study will address a gap in the literature, contribute to the body of knowledge, and may possibly assist policymakers and practitioners working in the field of gifted education.

While many studies were conducted on the effectiveness and implementation of different approaches to gifted education, there is a lack of studies on teachers' experiences implementing these approaches. Moreover, most studies on this topic have been conducted in the higher education context. To the best of my knowledge, no previous studies have addressed these issues in secondary education or gifted education. More needs to be understood about how teachers adjust to the changes in gifted and secondary education. The study will provide further data on the following topics: (1) the impact of adaptive learning on gifted learners' experiences from a school teacher's perspective, and (2) teachers' understanding and views who include adaptive learning in their program. This study will contribute to the body of knowledge about the effect of the teachers' view of adaptive learning on gifted students and their achievement outcomes.

The findings of this research may also shed light on the most effective instructional strategies that have a beneficial effect on the learning experiences and academic and nonacademic outcomes of gifted school students. Teachers and administrators of gifted students may utilize the study's findings to establish consistent teaching frameworks that address the unique requirements of gifted students. Additionally, the findings of this research may motivate instructors to create a consistent adaptive learning program that addresses the particular learning requirements of gifted students.

In sum, by addressing research questions, I intend to provide recommendations to schools that use adaptive learning, which might help them develop adaptive learning techniques to improve student outcomes.

1.6 Summary

Educational technology and tools play an increasingly crucial role in gifted education. In this study, I will uncover teachers' experiences with adaptive learning systems like ALEKS and CANVAS in gifted education. By exploring teachers' experiences, I plan to find out the challenges teachers face, strategies they find efficient in teaching, opportunities that adaptive learning systems provide, and the benefits and drawbacks of adaptive learning.

This thesis is organized into six chapters. The introduction chapter explains the conceptual foundation for the study, including the research questions and fundamental research design. The second chapter provides a comprehensive and balanced summary of the available literature pertaining to the suggested research topic. Chapter three describes the methodology of the research in sufficient detail, and describes the data collection procedure. The purpose of chapter four is to summarize the obtained data, describe its analysis, and then show the outcomes. The fifth chapter, discussion chapter presents an interpretation of the findings of the study. The main conclusions of the study are outlined in the Conclusion chapter, along with a final explanation of the findings. In this chapter, the study's contributions and the implications of the results for future study and practice are discussed.

2. Literature Review

This study aims to explore teachers' experiences in gifted education who have used adaptive learning technologies in the context of Kazakhstan. This chapter provides a review of the literature relevant to the current study. The purpose of this chapter is to identify central concepts related to the topic, synthesize and critically analyze the main debates, ideas, and controversies in the field, and uncover the deficiencies within pivotal empirical data connected to this study. The chapter is organized into seven sections. The first section states the purpose of the study and the overview of the organization of literature review chapter. The second section provides a detailed examination of three different pedagogical approaches that aim to meet the diverse needs of students in a classroom setting. The third section provides an overview and examination of Adaptive learning systems in educational technology. The fourth section is about the use of adaptive learning technology in gifted education. The section chapter provides an overview of the research on teachers' experience using adaptive learning. Additionally, this chapter offers the theoretical context of the study and research questions. This chapter concludes with a summary of the conducted research results and a critique of the research related to the topic of the study.

2.1 Conceptual Clarification: Differentiated, Individualized and Personalized Learning

Differentiated, individualized, and personalized learning are all pedagogical approaches that aim to meet the diverse needs of students in a classroom. These approaches have been gaining attention in recent years as a way to improve student learning and engagement. In this section, the key ideas of these three approaches will be presented, with a focus on their underlying principles, main features, and the potential benefits for students.

2.1.1. Differentiated Instruction

Differentiated instruction refers to the process of tailoring learning opportunities to meet each students' individual needs, interests, strengths, and needs (Kubat, 2018; Tomlinson, 2014). Differentiation is education that is tailored to the learning preferences of various students, where the learning objectives are the same for all students, but the instructional style or approach differs according to each student's preferences (Bray & McClaskey, 2015). Differentiated instruction comes in many forms. For example, teachers have the flexibility to group students by interest, provide different exercises, adjust learning objective demands, offer support and enrichment to struggling and bright students respectively, allocate time and encouragement to certain students, allow some to work alone, and adapt experiential learning styles to begin at a different point (Heacox, 2012; Watts-Taffe, Broach, Marinak, McDonald Connor, & Walker-Dalhouse, 2012). In order to meet the diverse needs of their students, teachers vary their instruction by adjusting the learning content, process, outcomes, and environment (Coubergs et al., 2017). Differentiation is not a simple path out of traditional 'one size fits all' approaches, but it can help mixed-ability classrooms improve instructional effectiveness and growth for all children (Valiandes & Neophytou, 2018). Yet, differentiated teaching poses a challenge to teachers. Teachers should endeavor to establish a profile of each student's shortcomings and strengths in order to offer a suitable education for all talented children and, in particular, gifted students from diverse cultural backgrounds (Scott, 2014). Possible obstacles for instructors also could include restricted access to differentiated resources, limited time for collaboration, and ineffective training.

2.1.2. Individualized Learning

In individualization, all students have the same learning objectives, but they may proceed through the material at varying speed based on their specific learning needs and abilities (Bray & McClaskey, 2010; Kuznetsova & Régnier, 2014). Most research on individualized learning has referred to customized teaching in terms of Individualised Educational Plans (IEP) in order to fit the needs and objectives of students with disabilities. Several scholars claim that individualized education is particularly appropriate to individualize content to enhance the learning experience for students with learning disabilities, but it may also help all students (see Shemshack & Spector, 2020). Learning is relatively passive in individualized learning environments as individual students are instructed by teachers or paraprofessionals. In this setting, a student has no say in the design of their education or choice in what they will learn (Bray & McClaskey, 2015). Thus, the instructor directs and accommodates the learning demands of each individual student.

2.1.3. Personalized Learning

Personalized learning is an educational approach that emphasizes the use of data and technology to customize instruction and assessment to meet the unique needs, interests, and abilities of each student (Chen et al., 2021; Roberts-Mahoney, Means & Garrison, 2016). The goal of personalized learning is to create a more student-centered approach to education by providing each student with the resources and support they need to achieve their full potential. It builds on the concept of individualized learning by providing each student with a personalized learning plan that is tailored to their specific needs, rather than providing a one-size-fits-all curriculum (McTighe & Brown, 2005).

Personalized learning often involves the use of digital tools, such as learning management systems, educational software, and online resources, to deliver instruction and

provide students with real-time feedback (Roberts-Mahoney, Means & Garrison, 2016). This technology can be used to help teachers create customized learning experiences for each student, track their progress, and adjust their instruction as needed.

Personalized learning also allows students to have more autonomy in their learning, providing choice and agency in what, how, when and where they learn (Breunlin et al., 2005; Courcier, 2007; Jacobs, 2014). Personalized learning programs often include elements such as self-paced instruction, project-based and inquiry-based learning, and competency-based instruction and assessment (Walkington & Bernacki, 2020).

Educators use the term "personalization" as an alternative to one-size-fits-all training, but many are confused about what personalized learning is and how it occurs in the classroom. Bray and McClaskey (2013) suggest three stages of personalized learning. The first stage is called “Teacher-Centered with Learner Voice and Choice” where the teacher knows how each student learns best and makes instructional choices on their talents, weaknesses, and areas of interest. Next, the instructor redesigns the classroom atmosphere and encourages student participation and autonomy. Finally, the instructor incorporates technology into the curriculum to train all students according to how they learn most effectively. The second stage is called “Learner-Centered with Teacher and Learners as Co-Designers” where the instructor and students determine skills and techniques for accessing and expressing knowledge. They co-create classes with a learner voice and choice in mind. Next, they are transitioning to a competency-based system in which students will demonstrate learning mastery. The third stage is called “Learner-Driven with Teacher as Partner in Learning” where learners direct their own education based on their own interests, goals, and questions. They monitor their own progress at their own pace with constant feedback.

Learner creates adaptable projects that allow them to use their own voices and selects the most effective method to demonstrate mastery. These three stages proposed by these authors may aid instructors' comprehension of personalized learning and help students acquire knowledge more efficiently.

2.1.4. The Relationship Between Differentiated, Individualized, and Personalized Learning

Differentiated instruction, individualized instruction, and personalized learning are all educational approaches that aim to meet the diverse needs of students in a classroom. They all pertain to approaches that modify instruction based on the preferences and needs of learners. In individualized education, for instance, learners may progress at different paces. In differentiated instruction, the instructional method may be adjusted to the preferences of the student. In personalized learning different pupils receive education that is paced according to their learning needs, adapted to their learning preferences, and suited to their individual interests.

However, while these terms are often used interchangeably, they do have different meanings and features. Clarke (2013) and Bray and McClaskey (2015) outline the most important differences, suggesting that the major contrast between the three approaches is the level of student choice and control over their learning. The first two are teacher-centered, while the latter is learner-centered (Bray & McClaskey, 2010; Garrick et al., 2017). Personalization happens only when students are actively engaged in selecting the subjects they examine, how they build new knowledge and skills, and how they display their learning (Bray and McClaskey, 2015). Similarly, Clarke (2013) claims that control distinguishes individualization from personalization; we may impose individualization on education, while students choose to personalize their own learning. LeGeros et al. (2022) support this idea and write that contrary to individualization and differentiation, personalized learning encourages

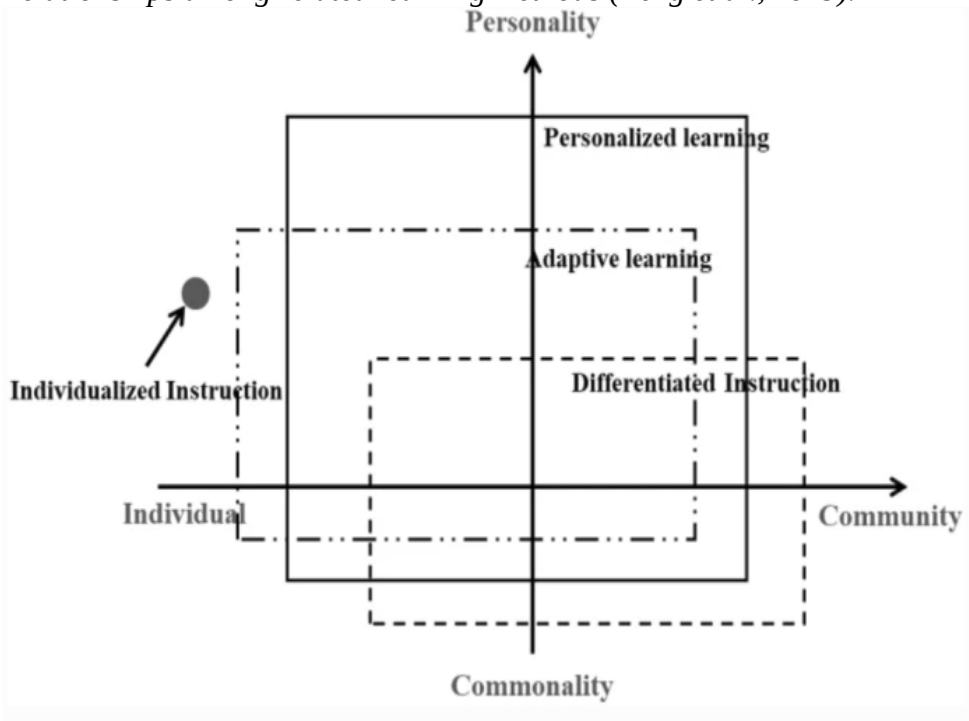
students to take ownership of and collaborate on their own education. Personalized learning differs from both individualization and differentiation in that it encourages students to take ownership of and co-design their own learning (LeGeros et al., 2022). Other definitions differentiate personalization from individualization and differentiation education by stating that it necessitates enhanced student voice and choice in the design, implementation, and administration of their learning (e.g., Netcoh, 2017).

Indeed, the concept of personalized learning is considered to be developed from the more basic concepts of individualization and differentiation (Redding, 2013). There are currently two prevailing perspectives on the relationship between personalized learning, adaptive learning, and differentiated instruction: (a) personalized learning includes differentiated instruction, and (b) the three approaches overlap with one another, similar to a Venn diagram (Peng et al., 2019). Analysis of their many meanings indicates the existence of both scenarios (Peng et al., 2019). Kurilovas et al. (as cited in Vesin et al., 2018) claim that environments for learning should personalize the learning process based on the primary features of their students. The combination of personalized learning with adaptive learning produces personalized adaptive learning (Peng et al., 2019). Differentiated instruction, which focuses on differences in individual characteristics, is the least individualized from a personality standpoint; adaptive learning ranks second, reaching the level of individual performance, while personalized learning ranks highest, achieving the goal of personal growth (see *Figure 1*).

By taking into account the chart developed by Bray & McClaskey (2010), I would infer that in personalization each student has his or her own goal of learning, while in individualization and differentiation students share one and the same goal. Differentiation adjusts learning needs, while individualization accommodates learning needs. Personalization relates to passion, interest, and ambition.

Figure 1

Relationships among related learning methods (Peng et al., 2019).



2.2 Features of Adaptive Learning Systems

Frequently, educational technology may operate as a facilitator or guide in teacher-student interactions. According to Merrill et al. (as cited in Wang et al., 2020) computer scientists and cognitive scientists have been creating adaptive learning systems that imitate the tutoring interactions of humans using artificial intelligence for over thirty years. Adaptive learning systems (ALSs) aim to give students an efficient, effective, and personalized learning experience by dynamically adjusting learning material to their specific abilities or preferences (Cavanagh, 2020; Khosravi et al., 2020). All adaptive learning systems adhere to a similar "closed loop" fundamental design that collects data from the learner and then utilizes those data to assess the learner's progress, offer learning activities, and deliver individualized feedback (Wang et al., 2020).

According to Park & Lee (as cited in Kem, 2022), adaptive learning systems provide learners personalized support with navigation, presentation, and material in the current learning environment. Adaptive learning platforms are centered on assessing students' needs

and offering support for learning (Taylor, Yeung & Bashet, 2021). There are different forms of adaptive learning systems, ranging from basic systems with predetermined rules to complicated systems with self-learning algorithms (Mirata et al., 2020; Pugliese, 2016). Because assignments are automatically assessed, students are able to obtain rapid feedback (Martin, 2020) and scaffolding as required (Taylor, Yeung & Bashet, 2021). Dashboards and data analytics of student performance in real time are crucial components of adaptive learning systems. Platforms for adaptive learning promote greater degrees of subject comprehension. Students may study material and repeat material and activities.

Adaptive learning systems are characterized by personalized learning routes, and teachers who use adaptive learning technology recognise the significance of giving tailored learning to students. Adaptive learning technology enhances instructors' creativity and flexibility to personalize learning experiences for each student, anywhere, at any time (Kem, 2022). Some adaptive learning systems contain profile information from other sources, but the vast majority of sophisticated systems generate a learning route at the moment of student engagement (Taylor, Yeung & Bashet, 2021). The tools can use the student's activity profile, learning analytics data, and machine learning to make real-time adjustments to learning paths, provide personalized scaffolding for each student, and target individualized intervention to improve student success (Taylor, Yeung & Bashet, 2021). Further investigation and comprehension of teachers' experiences will provide light on how technology might be used to optimize student learning.

2.3 Adaptive Learning for Maximizing Gifted Education

The International Society for Technology in Education (ISTE) and the National Association for Gifted Children (NAGC) encourages the effective use of technology by instructors for all children, particularly gifted students (Periathiruvadi & Rinn, 2012). In the subject of education, technology serves four functions: as a component of the curriculum, an

educational delivery method, a way of assisting instructors, and a means of enhancing the overall learning experience (Raja & Nagasubramani, 2018).

Adaptive learning is an instructional strategy that employs technology to provide students with a personalized learning environment (Forsyth et al., 2016; Shute & Zapata-Rivera, 2012). Shute and Zapata-Rivera (2012) summarize the challenges of adaptive learning technology application and maximizing the benefits to the learner is one of the key challenges. As a self-directed learning process, adaptive learning imposes additional requirements on teachers and students. “A framework for technology use in gifted education should include a long-term vision beyond specific applications to make technology a deep infrastructure for a new vision of gifted education that is more accessible, flexible, and truly learner centered” (Chen, Dai & Zhou, 2013, p.167). Students should learn to think broadly since being psychologically equipped for adaptive learning entails being ready for growth (Forsyth et al., 2016).

It is also commonly acknowledged that technology has considerable potential for boosting the efficacy and quality of gifted education; some experts argue that some technologies are especially advantageous for talented children (Siegle, 2005). Adaptive learning may enable teachers to present students with enriched and entertaining content that is suited to their individual talents and interests. Overall, adaptive learning may assist and maximize the potential of talented learners by providing them with personalized training catered to their specific needs and talents.

2.4 Teachers’ Experiences Using Adaptive Learning in Gifted Education

According to Besnoy (as cited in Chen et al., 2013), the usage of a personal technology improvement plan will enable teachers of gifted education to evaluate their technology requirements and construct a personalized professional development plan.

However, some teachers may find it very difficult to adapt to new educational approaches and tools. As Cavanagh et al. (2020) claim, “compared to traditional online courses, the instructor spends considerably more time developing assessment items and feedback than writing content” (p. 179).

Education is the field where meeting challenges is quite often and building a future learning environment is the solution. Educational context refers to the environment, scene or background information of learners when they carry out learning activities, including physical environments (such as classrooms, libraries, outdoors, etc.), virtual scenes (such as online learning platforms, mobile learning systems, network social activities, etc.) and knowledge backgrounds (such as the knowledge units or knowledge points currently being learned, and their positions in the entire knowledge graph) (Yang, 2019).

Despite the recognized advantages and rising interest in adaptive learning in the classroom, its widespread use remains restricted (Mirata et al., 2020). In their evaluation of prior research, Mirata et al. (2020) found different barriers and challenges for testing or implementing adaptive learning approaches, with technology, pedagogy, and management-related concerns being the most often cited categories. Taylor, Yeung & Bashet (2021) state that one of challenges of adaptive learning is providing engaging, robust, and relevant learning activities. They also note that alignment with course material is difficult since many faculty members define their own course topic. Particularly during the time of piloting adaptive learning, O'Sullivan (as cited in Mirata et al., 20120) asserts, faculties struggle with the use of adaptive software for connecting with students and adjusting learning material due to a lack of expertise with adaptive technology or insufficient assistance. Weber (as cited in Mirata et al., 2020) stated that the greatest obstacle today is an enormous commitment of time, money, resources, and vision, mostly owing to the remaining complexity of adaptive technology, expensive license prices, and enduring faculty skepticism over its ability to

disrupt education in general. Yet, no systematic categorization of the challenges associated with adaptive learning has been offered, and it remains unclear which issues need more attention during implementation (Mirata et al., 2020).

Personalized and adaptive learning provides excellent opportunities for enhancing student learning, yet it also poses a number of obstacles that instructors and institutions must overcome for adaptive learning to be successfully implemented (Greenhow, Graham & Koehler, 2022; Taylor, Yeung & Bashet, 2021). Adaptive systems have the ability to revolutionize education by delivering a student-centered design (Pugliese, 2016).

Austin Community College implemented adaptive learning by utilizing McGraw-Hill Education ALEKS as their adaptive learning courseware for personalized courses, resulting in the creation of the world's largest adaptive learning math lab and a decrease in student dropout rates (Alamri, Watson and Watson, 2020). There were some other colleges and universities which initiated the usage of McGraw-Hill Education platforms to provide personalized and adaptive learning opportunities. The software evaluates each student's learning development in order to deliver learning suggestions that meet their learning interests and requirements, as well as to modify their learning goals (Alamri, Watson & Watson, 2020).

Studies have looked into how teachers use adaptive learning technology in classrooms for general education. According to these studies, teachers generally view adaptive learning as a helpful tool for meeting the unique requirements of each student and delivering personalized instruction. The findings from these studies may be relevant for teachers in gifted education as one of the key principles of gifted education is to meet the needs of gifted students with unique learning needs and abilities. Because it can help to deliver a more personalized approach to teaching, adaptive learning technology may therefore be

especially advantageous for teachers in gifted education. This can help to challenge and engage gifted students at their level. However, it is crucial to remember that when implementing adaptive learning technology, teachers in gifted education may also face particular difficulties.

2.5. Theoretical Framework

A solid theoretical framework enables the researcher to identify existing biases about a study and facilitates data coding and interpretation (Collins & Stockton, 2018). A theoretical framework is essential for making sense of descriptive data and debating and disseminating conclusions so that they may be applied to comparable locations and populations (Collins & Stockton, 2018).

The theoretical framework of this study is based on the idea that adaptive learning can be used to support gifted education by providing students with instruction that is tailored to their individual needs and abilities and by providing teachers with the necessary knowledge and skills to integrate technology into their teaching effectively. The constructivist theory of learning and the Technological Pedagogical Content Knowledge (TPCK) framework guide the theoretical framework. More specifically, the study will explore teachers' perceptions of adaptive learning in gifted education in light of the constructivist theory and TPCK frameworks in order to understand how adaptive learning can be used to support gifted students' learning and development. The following sections unpack the notions of these theories and will be used as lenses to interpret and make sense of teachers' experiences implementing adaptive learning in gifted education in the context of Kazakhstan.

2.5.1. Constructivism

According to the constructivist theory of learning, students are active participants in a constructivist classroom, while the instructor acts as a facilitator and support guide. Constructivism is founded on the premise that learners create their own ideas about the

environment and what is known (Mann, 1994). The more constructivist a teacher's ideas were, the more the reported usage of technology in the classroom (Housand et al., 2021). Concepts from the Zone of proximal Development (ZPD) and more Knowledgeable other (MKO) elements of Social Constructivism (Vygotsky, 1978) provided the theoretical framework for this study of teachers' experiences with adaptive learning.

2.5.1.1. Zone of Proximal Development (ZPD)

The Zone of Proximal Development (ZPD) is a theoretical construct developed by psychologist Lev Vygotsky that refers to the difference between a student's current level of understanding and the level of understanding that can be reached with the help of a more skilled partner or teacher (Vygotsky, 1978). In other words, it is the distance between what a student can do independently and what they can do with guidance and support. According to the theory, maximum learning takes place in the ZPD and is promoted by proper scaffolding and support (Abtahi et al., 2017). The concept of ZPD is central to the idea of adaptive learning because it provides a framework for understanding the individual needs and abilities of students, and for determining the level of support and guidance that they require in order to make progress. By providing students with instruction that is tailored to their ZPD, adaptive learning systems can help students to achieve greater levels of understanding and mastery than they would be able to achieve on their own.

2.5.1.2. More Knowledgeable Other (MKO)

More Knowledgeable Other (MKO) is another central concept in Vygotsky's Social Constructivist theory of learning. The MKO is an individual or group who possesses a higher level of knowledge or understanding about a particular subject or task than the learner (Abtahi, 2017). The MKO serves as a model and a source of knowledge and support for the learner, guiding, supporting, and providing feedback to help the learner internalize new knowledge and skills, gradually increasing their level of understanding and ability. The MKO

serves as a scaffold for the learner, providing support that enables the learner to perform tasks that are beyond their current level of understanding and ability (Puntambekar & Hubscher, 2005). Cicconi (2014) noted that with the emergence of Web.2 technologies, an adaptive learning platform might be seen as an MKO in an online learning environment. Light and Pierson (2014) suggested that the more informed other person referred to in the ZPD idea may be a technological resource such as, for example, Khan Academy videos. These resources can provide learners with customized support and guidance based on their individual needs and abilities, much like a human MKO. For example, an adaptive learning system might adjust the difficulty of a task or provide hints and feedback based on the learner's performance, similar to a human MKO providing guidance and support. In other words, Adaptive learning systems use data on student performance to adjust the difficulty and content of instruction in real-time, providing students with a learning experience that is tailored to their individual ZPD. This way the system acts as a MKO by providing guidance and support when needed.

2.5.2. Technological Pedagogical Content Knowledge (TPCK)

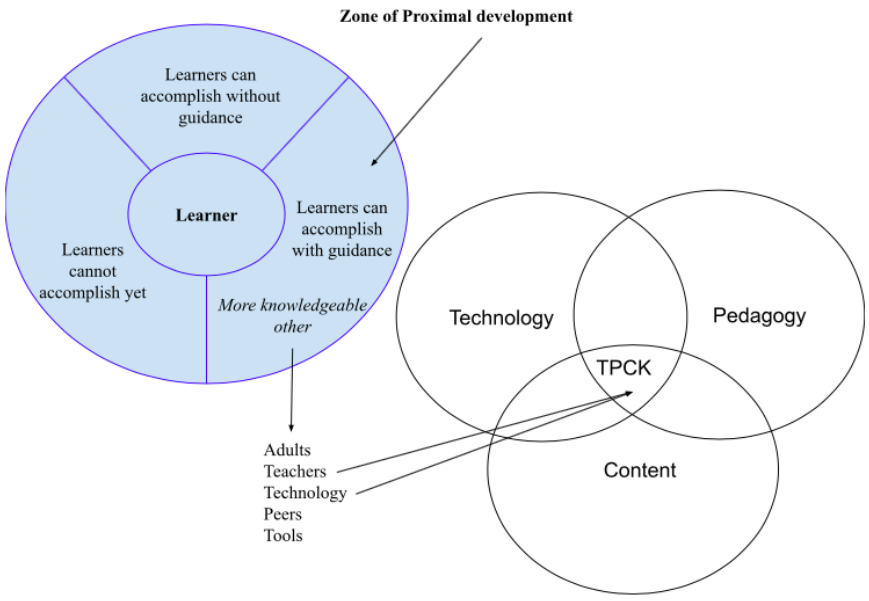
The Technological Pedagogical and Content Knowledge (TPCK), developed by Mishra and Koehler (2006), describes the knowledge that competent teachers in the digital age need to integrate technology effectively into their teaching. The framework consists of three types of knowledge: (1) Technological Knowledge (TK), or knowledge of the technology tools and resources that are available for teaching and learning; (2) Pedagogical Knowledge (PK), or knowledge of teaching and learning strategies and how to use them effectively; and (3) Content Knowledge (CK), or knowledge of the subject matter being taught.

The TPCK framework emphasizes that effective technology integration requires integrating all three types of knowledge, and it highlights that each is important and necessary. The fundamental purpose of technology integration is to improve the quality of learning interactions or to boost their efficiency and effectiveness because learning activities should elicit an emotional response that keeps the instructor and student relationship as the primary focus of learning (Napitupulu & Sebayang, 2022). Technology not only enables instructors to deliver personalized instruction for talented children and adolescents, but it also provides an educational and creative outlet for some of the world's finest and most brilliant minds (Periathiruvadi & Rinn, 2012).

Adaptive learning, as a teaching approach that uses technology and data to provide students with a personalized learning experience, requires teachers to understand how to use technology in teaching and learning. Teachers should have knowledge of the technology tools and resources available for teaching and learning, knowledge of teaching and learning strategies, and knowledge of the subject matter being taught.

Figure 2

Zone of proximal development and TPCK



2.7. Summary

This chapter provides a critical analysis of relevant literature to identify central concepts related to the topic, synthesize and critically analyze the main debates, ideas, and controversies in the field, and uncover the deficiencies within pivotal empirical data connected to this study. The goal of the literature review was to consolidate significant results and discuss the paradigm shift of incorporating technology such as adaptive learning technology into gifted education in order to promote meaningful learning experiences. It is essential to investigate teachers' experiences using adaptive learning technology in order to determine which technologies are useful, what challenges they face, what strategies they use, what opportunities they see, and finally, what benefits and drawbacks they identify in adaptive learning. Exists a void in the research about instructors' experiences using adaptive learning technologies in gifted education. Therefore, this research will contribute to the existing literature on teachers' use of adaptive learning technologies. In gifted education in Kazakhstan, adaptive learning is an emerging technique; hence, the literature is scarce.

3. Methodology

This section discusses the methodology used to address the main study question: How have teachers experienced the implementation of adaptive learning in gifted education? The chapter presents the research design, data collection procedures and instruments, ethical considerations that guided the study. I employed qualitative design that refers to a procedure for collecting, analyzing qualitative methods in a single study to understand a research problem.

3.1 Research Design

A qualitative approach was used to explore teachers' experiences of adaptive learning since it is based on “an interpretive paradigm and involves conducting interview research using focus groups as the data collection method” (Leavy, 2017, p 19). A qualitative approach allowed for an in-depth investigation of the phenomena while interpreting the cultural artifacts inherent within the social behaviors reported by courses taken information (Creswell and Poth, 2018). Qualitative research starts with assumptions and the interpretive/theoretical frameworks that guide the investigation of research issues addressing the meaning that people or groups give to social or human situations (Creswell and Poth, 2018).

This study will use a multiple case study research design to explore teachers' perceptions of adaptive learning in gifted education. Case study research is an appropriate method for this study as it allows for an in-depth examination of a specific phenomenon, in this case, teachers' perceptions of adaptive learning in gifted education, within its real-life context (Yin, 2018). Multiple case study design was chosen for this study due to its capacity to portray a single occurrence inside or apart from a wider phenomenon while fostering comprehension. This research does not qualify as a single-case study since it involves

interviews with educators from various regions of the country on their experience in implementing adaptive learning in gifted education, in one network of schools.

3.2 Participants

The population of this study is teachers using adaptive learning in gifted education in Kazakhstani schools. For this study a non-probability sampling method was used, namely purposive sampling, as “the subjects are selected because of some characteristic” (Patton, 1990). Purposive sampling helped extract a great deal of information from acquired data. This enabled a researcher to convey the magnitude of the results' influence on the population. Four special schools for gifted students implementing adaptive learning in East, South-East, South, and North Kazakhstan were selected for this study. Teachers with experience in teaching gifted students in adaptive learning in these schools were invited to participate in this study. The procedure used to recruit participants for qualitative research is crucial for preventing bias and effectively getting a representative sample (Arcury & Quandt, 1999). Participants were recruited through an email invitation from each school's principal to all teachers. Interested participants emailed the researcher back about their willingness to join in the research after receiving the email from their principals. The aim of the study, a description of adaptive learning, inclusion and exclusion criteria, University Ethics Committee approval confirmation, and researcher contact information were included in a recruiting email. In total, the number of participants involved in this study was eight.

3.2.1. Description of the Sample

The sample for this study consisted of eight teachers currently teaching in intellectual schools from different parts of the country, namely, East, South-East, South, and North Kazakhstan. There were four male and four female participants; and four chemistry and four physics teachers. Participants’ teaching experience ranged from four years to 27 years of working experience, with a mean teaching experience of 12 years. Of the eight participants in

the study, there were two experts, four moderators, and two teachers. Inclusion criteria required that participants are teachers who had experience using adaptive learning and were willing to participate in a one-hour-long interview. Teachers who did not meet these criteria were excluded from the study. Each participant was assigned an alphanumeric code: P1, P2 through P8. Each participant provided informed consent before data collection, participated of their own will and was free to leave the study with no penalty. No participants withdrew from the study. Table 1 provides a summary of the demographic and descriptive information for all participants.

Table 1

Demographic and Descriptive Data

Demographic Factor	No. of participants
Gender	
Male	4
Female	4
Interview language	
Kazakh	5
Russian	3
Working experience	
less than 5 years	1
5 to 10 years	3
11 to 20 years	2
20 years and more	2
Pedagogical level	
Teacher	2
Moderator	4
Expert	2
Teaching subject	
Physics	4
Chemistry	4
Adaptive Learning Platform	
ALEKS	1
Canvas	4
Both, ALEKS and Canvas	3

To address the study questions, the researcher classified themes that emerged from interview data. In addition, the data from the eight participants were collated in tables to

illustrate the frequency of identified themes in accordance with the aim of the research. Following the presentation of the data for each sub-research question is a chapter summary.

3.3 Data Collection Instruments

In addition to the researcher, the interview, which consisted of open-ended questions, was an essential component of this study. Yin (2003) states that case studies may gather data using a variety of methods, including questionnaires, interviews, observations, and written reports from the individuals. The purpose of using in-depth interviews in this study was to get a vivid picture of the participant's opinion on the study issue (Milena, Dinora & Alin, 2008). Further, semi-structured interviews allowed me to obtain a clear image of teachers' adaptive learning experiences in gifted education while allowing for follow-up and investigative inquiries.

3.3.1. Interview

The researcher aims to communicate the significance of the results from the viewpoint of the study participants, and to accomplish this purpose, data are acquired directly from participants (Bloomberg & Volpe, 2018). Particularly, Yin (2018) states that "interviews are an essential source of case study evidence because most case studies are about human affairs or actions" (p. 117).

The interview protocol comprised several sections. The first section included interview questions that helped me identify the demographic of participants, namely age, gender, level of education, what subjects they teach. The second section addressed the challenges they faced in adaptive learning. The third one covered answers of the opportunities of adaptive learning. The fourth section addressed the strategies that teachers use in adaptive learning and which they would like to share with their colleagues. The last section of the questions covered the benefits and drawbacks of adaptive learning. By asking such questions, I was able to get insight into the teachers' adaptive learning experiences. The

semistructured interview method aids in attentively listening to the participant's comments and asking study-related questions. Some sample questions include: The interview language, Kazakh, Russian, or English, was agreed with the interviewee at the beginning of the interview, and the questions in three languages are available in Appendix C.

All interviews were done electronically utilizing the Microsoft Teams educational platform. Since online learning was mandated by COVID-19, the Microsoft Teams platform was accessible to all workers in intellectual schools in Kazakhstan, and teachers know how to use it. A computer secured by a password was used to record, store, and evaluate interview materials. Microsoft Teams platform has transcribing capabilities, however, interview answers in Kazakh or Russian languages will be translated and transcribed by the researcher. According to the NU Ethics Policy, all downloaded data must be maintained for three years before being deleted from the laptop.

3.4 Data Analysis Procedures

For a qualitative data analysis interview, transcripts were transcribed and analyzed. The procedure for categorizing and codifying interview transcripts is best stated in terms of the steps that the researcher goes through (Burnard, 1991). Recording and transcribing were important in coding the results. Burnard (1991) suggests detailed steps of interview analysis. By re-reading the raw material, the data were split into meaningful units: giftedness and adaptive learning, the challenges, strategies, opportunities, benefits and drawbacks of adaptive learning, etc. Themes related to the study questions emerged from the data and were classified within the larger meaningful categories. Finally, the categories derived from the data were studied in further detail with respect to the study objectives and context. The researcher was able to answer the research questions after interpreting qualitative data. The findings obtained were first transcribed and then coded manually. Firstly, the findings were

organized for challenges of adaptive learning, then for strategies teachers use, opportunities of adaptive learning, and benefits and drawbacks of adaptive learning.

3.5 Reflexivity and Positionality

Reflexivity and positionality are important concepts in research methodology, particularly in qualitative research (Jacobson & Mustafa, 2019). Reflexivity refers to the researcher's awareness of their own biases, assumptions, and values that may influence the research process and outcomes. Positionality, on the other hand, refers to the researcher's social and cultural location, which shapes their perspectives and experiences (Holmes, 2020). In the case of the researcher conducting research in four institutions, being employed at one of these institutions could impact the participants' perceptions and behaviors. However, in this case, it seems that the researcher's positionality actually worked in their favor, as the participants were more trusting and critical towards adaptive learning. Nonetheless, the researcher should remain reflexive throughout the research process, acknowledging and addressing their own biases and how they may have influenced the results.

Data collecting preparation might be challenging. If not executed properly, the whole case study may be compromised, and all of the preceding efforts - in establishing the research questions and developing the case study - will have been in vain (Yin, 2018). As the instrument of data collection and data analysis, reflexivity must remain an active, conscious, and continuing awareness to confront, monitor, and act on your position as a researcher and the major influence that you have on your study, especially in terms of interpretation and representation (Bloomberg & Volpe, 2018). Throughout the research process, researchers must reflect on and appreciate their crucial position as research instruments. I, personally, have no experience with using adaptative learning technology in the classroom. However, I participated in a personalized learning project at one of the intellectual schools. Additionally, I am acquainted with the principles associated with adaptive learning technology as a result

of a thorough literature review, and this familiarity might generate the possibility for bias. Consequently, I participated in researcher reflectivity by engaging in critical self-evaluation and articulating my beliefs and assumptions connected to the study.

3.6 Ethical Considerations

Informed permission from prospective study subjects is currently the accepted and required method of ensuring their autonomy (Edwards, 2005). From the start, the research endeavor adhered to ethical principles and norms.

This study qualifies as no more than minimal risk research as it does not pose any harm or discomfort beyond those ordinarily encountered in daily life. Participants were recruited voluntarily and explained fully of the research aim nature. They were informed about the length of the interview, the topic of the research, and the specific requirements for participation. Each participant got an invitation letter, a consent form, and a letter of support from the research supervisor. The letter and consent form described the research aim, included a confidentiality declaration, and emphasized that participation is voluntary.

Human subjects must be protected due to the fact that almost all case studies include human affairs (Yin, 2018). All participants were ensured that they might withdraw from the research. Not only are such individuals free to withdraw at any moment, they do not need to provide any justification and may anticipate the same standard of care throughout, regardless of their behavior (Edwards, 2005). If the participant does not choose to respond to any of the questions during the interview, he or she may state so and the interviewer will move on to the next question.

The participants were told that the material acquired would be utilized in the creation of a qualitative research report that would be reviewed by the researcher's supervisor. Although some interview parts will be published in the final study report, participant names

and other identifying information will be kept confidential. Additionally, the researcher employed pseudonyms to safeguard the confidentiality and identity of participants for people other than myself and my supervisor. The participants were assured that the material recorded will be kept confidential, and that no one else will have access to the recordings save the researcher and her supervisor. The participants were notified that his or her involvement will help advance Kazakhstan's knowledge of gifted education and adaptive learning.

3.7 Summary

The purpose of this qualitative research is to explore and describe gifted education teachers' experiences using adaptive learning technologies. The purpose, types of research questions, and research design of this study were shortly presented in Chapter 3. In addition, the study's target population, sampling methodology, sample, tools and ethical considerations were described. The next chapters will include more research explanations and a comprehensive summary of the findings.

4. Findings

The purpose of this study was to explore and report perceptions and experiences of teachers who worked with adaptive learning in schools for gifted students in Kazakhstan. Participants' descriptive data were collected using semi-structured interviews in the framework of a multiple case study research design. This chapter presents the analysis of an examination of data collected using in-depth semi structured interviews with eight chemistry and physics teachers who participated in adaptive learning in schools for gifted students in Kazakhstan. The following sections describe the study and present the key findings obtained from eight in-depth interviews with teachers. A detailed discussion of the data analysis process and the results are also included. Following an analysis of the data, six broad categories that correspond to the research questions emerged: teachers' conceptualization of adaptive learning, strategies, challenges, benefits, drawbacks, and opportunities of Adaptive learning.

4.1 Teachers' Conceptualization of Adaptive Learning in Gifted Education

The findings of this study indicate that teachers' conceptions of adaptive learning in gifted education are diverse and heterogeneous. While some teachers conceptualize adaptive learning as a (technology-based) personalized approach, others view it as a way to individualized instructional approach to meet the unique learning needs of gifted and talented students. Moreover, teachers hold different and sometimes contradictory beliefs about the rationale for implementing adaptive learning in schools, the applicability of adaptive learning across subjects, and the need to receive specialized training for its effective implementation. Despite these differences, most teachers agree that adaptive learning can be a suitable approach for all learners, not only gifted and talented students.

4.1.1 Heterogeneous Teachers' Perspectives on Adaptive Learning

The findings of this study reveal that teachers' perceptions of "adaptive learning" are heterogeneous, with some interpreting it as a means of personalization, others as personalization of learning with technology, and still others as a technique for individualizing learning. According to three educators, adaptive learning is a personalized instructional approach that caters to the specific needs and abilities of individual students. This method is characterized by its focus on personalization and independent development, allowing students to work according to their own capabilities rather than simply receiving information from their instructors. Additionally, adaptive learning is considered to facilitate the development of students' abilities to the fullest extent possible while allowing them to progress at their own pace. Furthermore, these educators posit that adaptive learning is an ongoing process that is still in the process of being fully understood and mastered, possessing unique characteristics that set it apart from other educational approaches.

> "It is difficult to give an exact definition. This is an individual approach to each student, a personalized approach, that is, each student has a development trajectory, creating conditions at different levels related to each student's personal route. Thus, the student will have a development trajectory that is independent of anyone, according to his abilities, and the direction will play the role of a guide". Participant 5.

Two teachers in the sample believe that adaptive learning is a *technology-based personalized instructional approach* that integrates both in-class and out-of-class learning activities. This is achieved through the utilization of *technology-enabled platforms* that provide students with access to theoretical content, while also enabling independent and self-paced learning. Moreover, it is highlighted that this approach encourages interactive forms of instruction, such as class debates, group projects, activities, and decision-making, thereby fostering student engagement and collaboration. The educators contend that adaptive learning

enables students to pursue self-directed learning while still benefiting from teacher guidance and support. By employing an adaptive learning strategy, students can readily access, review, and complete coursework from the comfort of their homes, at their own pace.

> "I haven't read about adaptive learning beforehand. I realized something by using Canvas, ALEKS. Adaptive learning is learning in which students learn and prepare on their own, and when the teacher gives them a little direction, students help themselves to be themselves. Because we provide students with important information during school hours, they can look at assignments from home, re-read what they don't understand, and develop independently". Participant 7.

Another group of educators defines adaptive learning as an individualized instructional approach that takes into account students' abilities, level, potential, personality, individual character, and learning preferences. These three educators assert that this approach aims to provide maximum knowledge, skill development, and critical thinking by assessing each student as an individual and finding the level of instruction that is most comfortable for them. The group also recognizes home-schooling as a form of adaptive learning. Essentially, adaptive learning is for this group a pedagogical framework that teachers can use to implement effective learning processes and achieve educational goals by tailoring instruction to meet the needs and capabilities of individual learners. The key characteristics of adaptive learning lessons are that students have opportunities for independent learning and access to various learning resources. Teachers can monitor students' progress and adjust their instructional methods to remove obstacles to learning. P8, stated that "In my opinion, adaptive learning is a situation and an opportunity created by the teacher, taking into account the needs and capabilities of the student, to effectively implement the learning process, to achieve the learning goal".

4.1.2. Rationale for Implementing Adaptive learning

Educators articulate diverse rationales for the adoption of adaptive learning in their schools. Participants recognize adaptive learning as a contemporary pedagogical trend that enables personalized and individualized instruction, thereby fostering optimal learning environments for students while streamlining the teaching process. Thus, teachers believe that the implementation of adaptive learning addresses individual student needs and abilities, keeps up with the latest developments in education, and improves overall educational quality. Additionally, schools have sought to prepare for distance learning or online classes, to help students develop their abilities and talents and prepare them for lifelong learning. Notably, some participants acknowledge that the COVID-19 pandemic has compelled them to explore effective online learning alternatives, and they found adaptive learning to be a suitable approach.

> Well, in general, now the trend of education is, of course, the spheres of adaptive education, personalized learning, inclusion in education. Therefore, we did not have such a platform, and according to the strategy, we began to work in this direction. We began to create our own platforms, like NIS online, NIS LAB - this is virtual laboratory work, virtual work, virtual subjects and including adaptive-active learning. Participant 2.

4.1.3. Applicability of Adaptive Leaving across Subject Areas

There seems to be a substantial disparity in participants' perspectives concerning the potential utility of adaptive learning in different subject areas. Specifically, the results revealed that half of the instructors view adaptive learning as a beneficial approach across all academic domains, while others maintain that its applicability is limited to STEM disciplines. This divide seems to be attributable to the perception among some educators that adaptive learning can be especially effective in subjects that require numerical problem-solving and short written responses, which are more commonly associated with STEM fields.

> It is possible to integrate all subjects, although it is often more effective and suitable for subjects in the natural sciences. In those lessons, students can enter specific answers. Exact numerical responses can be evaluated. Short written responses are also accepted. I think it's more difficult for other language subjects. Participant 5.

Nonetheless, some participants recognized that adaptive learning may have potential applications in other non-STEM subject areas, such as language classes. However, the efficacy of this approach in language instruction is believed to be constrained by the limitations in evaluating speaking proficiency in written responses. It was emphasized that the effectiveness of an adaptive learning program is contingent upon the inclusion of clear learning objectives. Additionally, the participants underscored the significance of information analysis and communication in the humanities, which may limit the suitability of adaptive learning in these subjects.

> Well, of course, the subject of the natural science is better suited. For humanitarian subjects, this is also possible, why, because there can also be online resources, Internet resources, video resources, and at the end the student can do the task on them. And on this side, the only disadvantage will be that there will be no skill, such as, for example, speaking. Our languages are divided according to several skills. These are reading, speaking, listening, writing. If it is possible to test and improve reading, listening and writing on an active system, speaking is not affected there. Participant 2.

4.1.4. Professional Development for Adaptive Learning Implementation

Teachers reported conflicting opinions on the necessity of specialized training to effectively implement adaptive learning. While some contend that professional training is essential for the effective utilization of adaptive learning, as it facilitates a deeper understanding of the concept and the various available platforms, others maintain that academic knowledge and technological proficiency alone suffice for using adaptive learning without any special training. In addition, certain participants emphasize the significance of

continuous support, such as a TEAMS support group, in the successful implementation of adaptive learning in the classroom.

> For me, the disadvantage is that students and teachers still do not fully understand AL. The organizer explained to us that we, the teachers, still need support. Courses are still needed to successfully organize AL entirely in the classroom. Participant 5.

4.2.5. Suitability of Adaptive Learning for All Students

The results of this study indicate a high level of consensus among the interviewed teachers regarding the value of adaptive learning for students with varying levels of ability. Specifically, all participating teachers expressed agreement with the idea that adaptive learning is beneficial not only for gifted and talented students but also for students with diverse learning needs and backgrounds. These findings suggest that adaptive learning holds promise as an effective approach to meeting the diverse educational needs of students, regardless of their ability level. However, they also acknowledge that it may require additional monitoring for lower ability students and may not be enough for gifted students, who may need individual attention from the teacher. The participants believe that the teacher can use adaptive learning to monitor student progress and help students realize their potential through support and practical work.

> Of course, it is useful for all students, because there is a special algorithm for it, the information is given step by step. Children can see where they stand, see what direction they should work. The teacher also teaches according to the student's ability. But here, with non-gifted children, the teacher helps to realize the potential of other children, depending on the learning goals, through the support of the teacher or the zone of proximal development. Gifted education is offered to students of all grades, but special attention is given to students who are not gifted. Then, for example, when I give tasks in advance, when we come to class, we fix the topic and do practical work. At that time, the teacher can see which child has learned well or where questions have

arisen. Allows you to see which students need what support. Students will have the opportunity to gradually develop working skills. Participant 8.

4.2. Teachers' Experiences with Adaptive Learning in Gifted Education

The analysis of the data indicated that teachers demonstrate a strong understanding of the importance of adaptive learning and its potential benefits for students. They recognize that it is not a one-size-fits-all approach and that teachers need to be prepared and knowledgeable about the chosen platform and how to use it effectively. They also believe that it is important to combine adaptive learning with active learning to ensure that students do not feel isolated and that they understand the purpose of the training. They seem to believe that it is best used as a self-control task or as a way to consolidate knowledge after a lesson. Their future strategy includes incorporating more demonstration and laboratory work to help students develop their application skills. Overall, it seems like they have a clear vision for how they want to incorporate Adaptive learning into teaching and the importance of teacher responsibility in making it successful.

4.2.1. Teaching Approaches for Effective Adaptive Learning

As the researcher delved deeper into exploration of teaching approaches for effective adaptive learning, it was found out that the insights of educators proved to be invaluable. Through my conversations with them, I was able to identify various strategies and techniques that they had employed in their own classrooms. One teacher suggested taking advantage of students' laptops to perform virtual lab work, while another emphasized the importance of gradually introducing adaptive learning to accommodate varying abilities. Monitoring student progress and providing support is crucial, and finding the right balance is key to prevent isolation. Effective organization involves individual seating and teaching students how to use the platform. Pairing students with different assignments before individual work and using adaptive learning in moderation are also recommended by teachers for the effective

implementation of Adaptive learning. Aligning the platform with learning goals and objectives and incorporating approaches such as flipped classes and reflection can enhance the learning experience. Ultimately, the teacher's mastery of material, feedback, and progress monitoring are vital to the success of adaptive learning.

> In my opinion, it is necessary to introduce adaptive learning gradually. Because every child, every student has certain possibilities. I believe that it is necessary to enter children who need to go beyond a certain circle. Because it is a great opportunity for gifted students and the teacher to develop the skills of certain students. Perhaps it depends as much on teacher preparation as it does on teacher access to resources. Of course, it depends on the number of students. Because I teach 5 classes, the number of students in those 5 classes is less than 60. And now there are 30 children in one class of mainstream schools. In that case, I think it can cause problems for teachers. Participant 8.

4.2.2. Preparing for Challenges of Adaptive Learning

During the data analysis process, four overarching themes that capture the difficulties faced by teachers and students while using adaptive learning in the classroom were discovered.

The first theme focuses on technological difficulties, such as problems out-of-date gadgets or operating systems. Such issues can negatively affect the platform's performance, frustrating students and teachers and causing delays. When multiple classes attempt to use adaptive learning simultaneously, the platform's performance can slow down significantly, creating frustrating and time-consuming issues for both students and teachers. Furthermore, if a student's device or operating system is outdated, they may not be able to support the adaptive learning software, leading to further complications and delays. P2, claimed that "…it is not possible to conduct qualitatively because of the ICT possibility of it. That is, we have the Internet lagged, our tablets weren't ready for this platform". However, technical

difficulties are just the beginning. Many educators and students may also face challenges adapting to this new form of learning. For some teachers, adapting to new technology can be a daunting task, particularly if they are not comfortable with technology in general. Students, too, may experience difficulty adapting to a new way of learning, especially if they are accustomed to more traditional teaching methods.

The second theme is about pedagogical challenges, where teachers and students may have a hard time adjusting to a new way of learning, especially if they are used to more conventional teaching techniques. Some teachers may find it difficult to adjust to new technology, especially if they are not generally at ease with it. Therefore, effective implementation of adaptive learning depends on teachers and students receiving the appropriate training and assistance.

The third issue is managerial difficulties, such as choosing and arranging platform materials. Teachers must make sure that students are equipped with the appropriate knowledge and remain inspired to use the platform. All parties involved must carefully prepare, coordinate, and communicate to accomplish this.

Perhaps the most significant challenge of all, however, is motivation. Not all educators and students may be motivated to embrace this new approach to learning, particularly if they are more comfortable with traditional methods. Proper selection and organization of platform materials is also essential to ensure that students receive the necessary skills and stay motivated to continue using the platform.

> Well, the most important thing, let's say, the difficulty was the transition from the old to the new for me personally, and for the students I am sure too, because our students are used to the fact that we have an ordinary combined traditional lesson. Participant 1.

4.2.3. The Potential Benefits of Adaptive Learning

It was discovered through teachers interviews that adaptive learning can greatly help students. Teachers have noticed that adaptive learning gives students the option to select tasks that are appropriate for their skills and interests. For gifted children who might be disengaged by conventional classroom techniques, this is very advantageous. Adaptive learning increases student engagement and motivation by letting them explore their interests and study at their own pace.

However, educators have noticed that struggling students also benefit from adaptive learning. These students do not feel overwhelmed or disheartened by stuff they may not be ready for yet because they may take their time to comprehend fundamental ideas before moving on to more complicated issues.

Adaptive learning encourages independent learning, which teachers have found to be crucial for fostering the development of critical abilities including self-evaluation, autonomy, and decision-making. In order to develop a sense of ownership and responsibility for their own learning, students are encouraged to assess their progress and complete schoolwork on their own. According to what teachers have seen, this keeps students interested in learning and motivated, both of which are essential for their academic performance.

Additionally, according to teachers, adaptive learning platforms give students personalised feedback that helps them recognise their strengths and weakness. As a result, students can more effectively use their time and energy by concentrating their efforts where they need to improve.

> I believe, adaptive training allows us to implement personalized learning. …since we work for the student, we must first of all think about how to create comfortable conditions for a particular student, and adaptive learning allows us to do this. P1

4.2.4. The Drawbacks of Adaptive Learning

According to the interviews with teachers, adaptive learning presents various challenges that affect the teacher-student relationship, group work, communication, and academic integrity. Teachers are concerned that the use of technology can lead to a lack of communication and cooperation between students, which is essential in group work.

> And it can't provide a full teacher-student relationship. If we teach on the platform, if we teach at a distance, we cannot fully provide a live interactive relationship between the student and the teacher, so I think that we cannot completely transfer to AL. P5

Some teachers also worry that using electronic resources can negatively impact students' health, as indicated by P8: "*The disadvantage is that the resources children are using are on the platform, that is, electronic tools. It affects their health, they should rest their eyes*." Furthermore, academic honesty is a significant concern since teachers cannot monitor students' internet use during assessments. Additionally, the lack of practical work can negatively affect student motivation and interest in the material and some students may fall behind if they cannot keep up with stronger students. This was illustrated by P4 as follows: "… but the downside was that some students could not keep up with strong students and their performance dropped**."** Therefore, teachers believe that it is important to find a balance between adaptive learning and traditional teaching methods to address these challenges.

4.3. Teachers' Approaches to Implementing Adaptive Learning in Gifted Education

The educators claim that adaptive learning gives students a special chance to learn at their own speed and advance their skills. They lauded the platform's capacity to employ artificial intelligence to determine each student's areas of strength and weakness and to modify assignments accordingly. This makes it possible for a more personalized approach to

learning, which can be helpful for exceptional children who might otherwise find typical classroom techniques boring and unchallenging.

The participants emphasised the platform's capacity to provide gifted students with challenging material and to get them ready for events like the national and international Olympiads. These students may learn at their own pace thanks to the platform, which also gives teachers the ability to monitor their development and offer assistance and feedback as needed.

> What I liked the most was that I had students in some classes who were very talented, and I would give them the topic in advance, and they would study it beforehand. Accordingly, I was preparing complex Olympiad tasks for them. Then those students studied several topics and won an award in the national and online Olympiads. This is one advantageous side. P4

Teachers must be able to track their students' development and offer feedback and support when required if adaptive learning is to be used effectively in gifted education. The platform has a number of features that teachers can use to monitor student achievement, such as displaying students how they met their objectives, charting their development, and identifying students who require additional support.

> Even now it is useful for students. Sometimes students miss classes, sometimes they get sick, or they go to competitions, and then the student looks at the learning goals and can go into that Canvas, see what information needs to be read, what needs to be known, and prepare for the summative work. P7

An overview of the themes and subthemes of the study can be found in the accompanying Table 2, providing a clear and concise representation of the research findings.

Table 2

Summary of Themes and Subthemes

Themes and Subthemes	Frequency	Participants
CONCEPTUALIZATION		
Adaptive learning is		
Personalization	3	1, 5, 6
Personalization with technology	2	2, 7
Individualization	3	3, 4, 8
Adaptive learning is		
For gifted students only	0	
For all students	8	1, 2, 3, 4, 5, 6, 7, 8
Adaptive learning is		
For any subject	4	1, 2, 4, 7
For STEM subjects only	4	3, 5, 6, 8
Professional development		
Teachers need PD	4	1, 3, 5, 8
Teachers do not need PD	4	2, 4, 6, 7
STRATEGIES		
Organizational	3	1, 6, 8
Pedagogical	5	1, 3, 4, 5, 8
Class management	2	4, 8,
Curriculum and Instruction	3	1, 7, 8
Technology	6	1, 3, 4, 5, 7, 8
CHALLENGES		
Technology-related	4	1, 2, 3, 5
Pedagogical	2	2, 5,
Management	4	1, 4, 5, 7
Psychological	1	1
BENEFITS		
Personalization and student-centered learning	4	1, 2, 5, 7
Learning experience and progress	5	1, 2, 5, 6, 7
Engagement and Motivation	3	4, 5, 6,

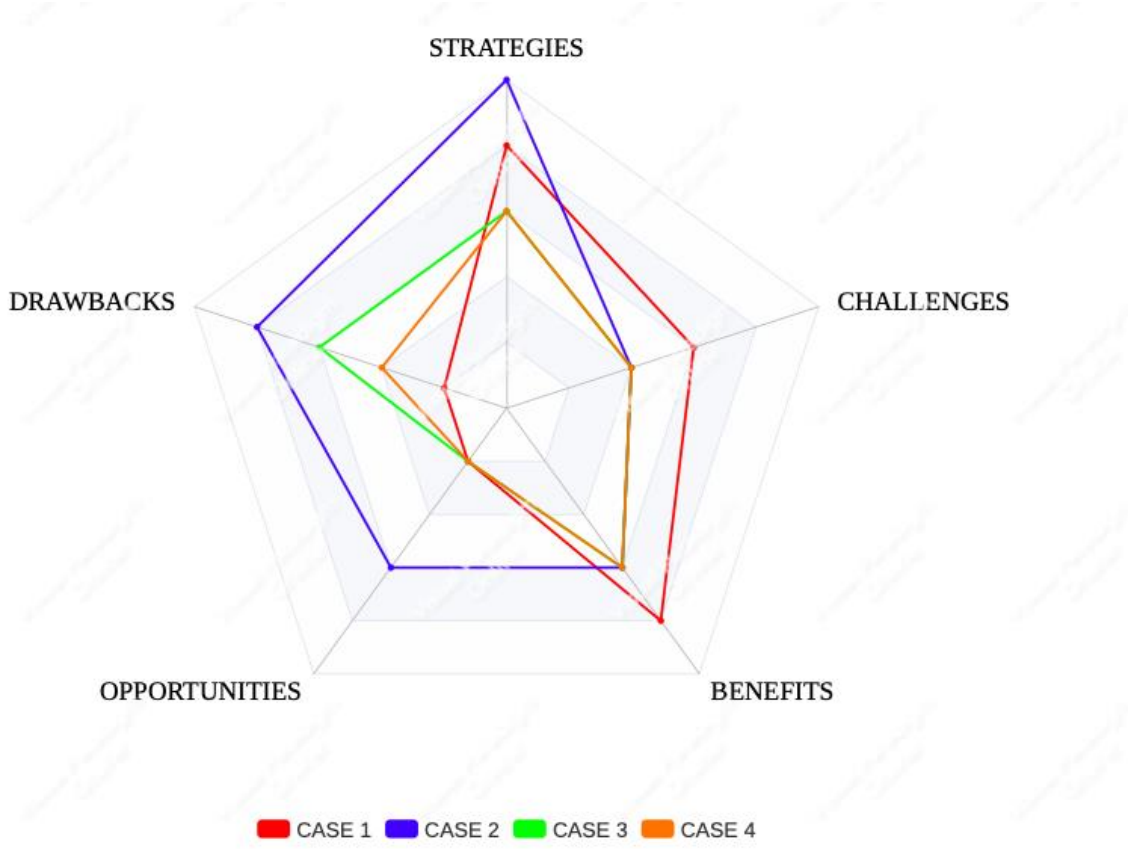
Simplification of learning and Metacognition	3	1, 3, 8
DRAWBACKS		
Interaction and Communication	5	1, 2, 3, 5, 8
Organizational	1	3
Academic integrity	1	2
Curriculum	2	2, 7
Health issues	1	8
Teaching	2	4, 7
OPPORTUNITIES		
Learning environment	4	1, 6, 7, 8
Olympiad preparation	2	4, 8
Assessment	1	2

4.4. Triangulation

Triangulation was used in a study to examine the perspectives of four schools on implementing Adaptive learning in their classrooms. Figure 3 depicts the number of themes highlighted by teachers during the interview. The teachers mentioned the strategies they used, the challenges they faced, the benefits they observed, the opportunities for improvement, and the drawbacks of adaptive learning. As it can be seen from the Figure, teachers from School 2 (Case 2), mentioned more strategies, more drawbacks, and more opportunities than other three schools while School 1 (Case 1), saw more benefits and experienced more challenges than other schools. Both School 3 (Case 3) and School 4 (Case 4) shared almost the same perspectives. Overall, the teachers' perspectives on adaptive learning revealed a complex picture, highlighting both potential for positive impact and the need for careful consideration and planning.

Figure 3

Triangulation of teachers' experience with adaptive learning. Four schools



4.5. Summary

This chapter presented eleven findings uncovered by this study. Findings were organized according to the research questions. Data from individual interviews revealed research participants' perceptions and experiences of adaptive learning. In accordance with the nature of qualitative research, the report contains several participant quotations. By using the participants' own words, the researcher wants to gain the readers' trust by correctly describing the investigated individuals and situations.

The primary finding of this study is that teachers think that adaptive learning is a beneficial tool for all kids, not just the gifted ones. Different teachers have different meanings of adaptive learning, but most of them concur that it can improve personalized learning,

student-centered learning, learning experience and progress, engagement and motivation, and learning simplification and metacognition. However, there are other issues that must be resolved, such as technological, educational, managerial, and psychological difficulties. Teachers must use a variety of strategies, including organizational, pedagogical, class administration, curriculum, instruction, and technology strategies, to maximize the possibilities of adaptive learning. The results of this research show that adaptive learning has the potential to enhance student learning outcomes and assist teachers in their instructional strategies.

Overall, teachers view adaptive learning as beneficial and would encourage other educators to adopt the technology. Participants stated that Adaptive learning promotes student-centered learning, improves summative assessment scores, facilitates active scaffolded learning and Olympiad preparation, increases motivation, and provides course content in digital formats to accommodate diverse learning styles and preferences.

Rich descriptive data extracts in the form of participant quotes were supplied in Chapter 4 to support each theme and subtheme. The study findings will be extensively discussed in Chapter 5.

Eleven major findings emerged from this study:

1. Teachers' definitions of "adaptive learning" are diverse and account for personalization, personalization with technology, and individualization of learning;

2. Teachers recognize the importance of personalized learning and see adaptive learning as a way to tailor instruction to individual student needs;

3. Teachers believe that adaptive learning is beneficial for all students, not just gifted students. With personalized learning, all students are able to work at

their own pace and receive individualized assistance, allowing them to realize their maximum potential;

4. Some teachers believe that adaptive learning can be efficient in any subject, while some teachers claim that adaptive learning can be used in STEM subjects only;
5. Teachers perceive adaptive learning to be most effective when used in combination with traditional active learning, rather than as a replacement for it;
6. Teachers express concerns about the potential for adaptive learning to replace human interaction and the importance of maintaining teacher-student, student-student relationships;
7. Teachers implement several strategies to successfully use adaptive learning in their teaching, including organizational, pedagogical, class management, curriculum, instruction, and technology strategies;
8. Teachers face challenges in implementing adaptive learning in their classrooms due to limited technology resources and lack of training;
9. Benefits of adaptive learning as perceived by teachers include the personalization of student learning and the promotion of student-centered learning; positive impacts on student learning experience, progress, engagement and motivation; simplification of learning; and improved metacognition;
10. Teachers identified several drawbacks in the use of adaptive learning, including the organizational issues related to managing adaptive learning

programs, concerns about academic integrity and cheating, challenges related to aligning adaptive learning with the curriculum, potential health issues related to excessive screen time, and concerns about the impact of adaptive learning on the role of the teacher in the classroom.

11. Teachers note that adaptive learning provides opportunities for students to learn in different environments, beyond the traditional classroom setting. Teachers see adaptive learning as a useful tool for preparing students for Olympiad competitions and exams, as well as for assessing student learning and progress.

5. Discussion

It is crucial to investigate and comprehend how teachers are using the technology to meet the learning requirements of gifted students given the upward trend in adaptive learning technology. The purpose of this qualitative study was to explore and characterize the experiences of teachers who have used and/or are currently using adaptive learning technology in gifted education. The research used a multiple case study research design to collect data by semi-structured interviews with teachers. The study and the findings of the data analysis were all provided in Chapter 4. The themes outlined in Chapter 4 are supported by specific participant quotes. Participants in this study included chemistry and physics teachers from intellectual schools from different parts of the country. The data were collected over an extended period of time and analyzed thematically, resulting in the development of a coding framework. This study was based on the following research questions: (1) How do NIS teachers conceptualize adaptive learning in gifted education? (2) What are NIS teachers' experiences with adaptive learning in gifted education? (3) How do NIS teachers approach the implementation of adaptive learning in gifted education?

In general, the findings of this study suggest that NIS teachers employ their own conceptualization of Adaptive learning. They conceptualized Adaptive learning as an effective strategy that had the potential to increase the effectiveness of their teaching by taking students' needs and interests into consideration. The most important factors facilitating the implementation in the classroom are time, balance of the class, the use of ICT tools, teaching methods and pedagogical approaches.

These findings are discussed in this chapter in close alignment with the research questions. This discussion takes into consideration the literature on three different pedagogical approaches, overview and examination of Adaptive learning systems, and teachers' experience using adaptive learning. This allows for a comprehensive understanding

of how the research questions were addressed and how the findings contribute to the existing body of knowledge on the topic. The implications of these findings are intended to inform future research, guide practical applications, and contribute to theoretical advancements in the field. By providing a detailed analysis and interpretation of the results, this chapter aims to facilitate a deeper understanding of the research outcomes and their broader significance.

This chapter is organized into five sections. The first section aims to provide a summary of the findings of the study and reflect on its significance and potential contributions to the field. In the following three sections the research questions are revisited and the findings are summarized. The chapter concludes with the reflection on the significance of the research and the potential contributions to the field.

5.1 Teacher's Conceptualizations of Adaptive Learning

Teachers hold multiple conceptualizations with regards to how they understand adaptive learning. In terms of its adequacy across different subjects, teachers have differing opinions based on their subject area expertise and experience. Participants were chemistry and physics teachers and they see adaptive learning as a valuable tool for personalization on students' prior knowledge and skill levels, however they show concerns about how well an adaptive system can account for the complexity of language acquisition and the importance of social and cultural factors in language learning. In terms of agreement about being useful approach for all students some claim that it can help all students by offering more personalized learning experiences that cater to their own needs and interests, while others counter that it can help students who are struggling or have special needs.

The findings of this study revealed that teachers hold diverse views regarding adaptive learning in gifted education. While some teachers view adaptive learning as a personalized, technology-based approach, others see it as a tailored instructional method to meet the unique learning needs of gifted students. Overall, the multiple definitions provided

by teachers align with the most typical conceptualizations of adaptive learning in the literature (Khostravi et al., 2020). There are several reasons that could account for this diversity of perspectives among the study participants. Firstly, since adaptive learning is a recent addition to specialized schools for gifted students in Kazakhstan, teachers may not yet have a shared understanding of its principles and foundations. The application of adaptive learning in higher education is hindered by the absence of clear and consistent terminology throughout the educational sector (Cavanagh et al., 2020). Secondly, differences in educators' understanding of key concepts related to adaptive learning, such as differentiation and personalization, may also contribute to the divergence of opinions (Van Casteran et al., as cited in Smale-Jacobse et al., 2019). Thirdly, these divergent views could be due to differences in educators' training, experience, and attitudes toward technology integration, as suggested by Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) framework. This finding underscores the complexity and diversity of technology-supported learning approaches. It is crucial for teachers to be aware of and sensitive to the various conceptions of adaptive learning among their colleagues. By doing so, they can communicate more effectively and establish a shared understanding of what adaptive learning means in the context of gifted education. However, adaptive learning requires significant investment in technology and professional development, which may be beyond the means of some schools and districts. Additionally, some students may not have access to the technology needed to fully participate in adaptive learning programs, which could exacerbate existing achievement gaps.

Despite these differences, all teachers in the study understand the significance of personalized learning and recognize adaptive learning as a means to personalize instruction to meet the individual needs of each student. This is a positive development, as personalized learning has been shown to lead to increased student engagement, motivation, and

achievement (Chen et al., 2021; Roberts-Mahoney, Means & Garrison, 2016). Adaptive learning tools can provide students with tailored content, pace, and feedback based on their strengths, weaknesses, and learning preferences (Association of Public & Land-Grant Universities, as cited in Cavanagh, 2020; Khosravi et al., 2020). By using these tools, teachers can provide a more personalized learning experience, which can lead to better outcomes for their students. Additionally, the recognition of the importance of personalized learning by teachers indicates a willingness to adapt and innovate their teaching practices to meet the evolving needs of their students.

An important perspective among teachers found in the study was that adaptive learning is not just beneficial for gifted students but for all students. This is consistent with previous studies that found that personalized learning through adaptive learning tools allows students to work at their own pace and receive individualized support, enabling them to achieve their full potential (Kem, 2022). Moreover, this approach recognizes that every student has unique strengths and weaknesses, learning styles, and interests, and can benefit from tailored instruction that meets their specific needs. This is very important as this perspective challenges the traditional "one size fits all" approach to education, which can often leave many students behind. By using adaptive learning tools to provide personalized instruction, teachers can create a more inclusive and equitable learning environment that accommodates the diverse needs of all students (Taylor, Yeung & Bashet, 2021). Ultimately, this method can assist students in developing into more independent, driven, and confident learners who are better prepared to achieve in the classroom and beyond.

Still, there were different opinions among teachers regarding the efficacy of adaptive learning across different subjects. Some teachers believe that adaptive learning can only be effectively implemented in STEM subjects, while others see potential to improve teaching and learning also in non-STEM areas. The effectiveness of adaptive learning in any subject

area may depend on the specific needs of individual students and the quality of the adaptive learning tools used. This is important because it sheds light on the varying opinions among teachers regarding the effectiveness of adaptive learning tools in different subject areas. The debate between those who believe that adaptive learning can be used in any subject area and those who argue that it is most applicable to STEM subjects has implications for how educators utilize these tools in the classroom. In practice, adaptive learning has been used more intensively in STEM subjects than in non-STEM subjects (Allen, Webb & Matthews, 2016; Taylor, Yeung & Bashet, 2021). This has contributed to a debate between educators who believe that adaptive learning can be used in any subject area and those who argue that it is most applicable to STEM subjects. It is worth noting that all of the teachers interviewed in this study taught STEM subjects, and therefore their opinions might be biased or they might not be able to recognize the value of adaptive learning in non-STEM classes. Further research and experimentation in different subject areas could provide more insights into the benefits and limitations of adaptive learning.

5.2 Teachers' Experiences with Adaptive Learning in Gifted Education

A potential strategy for addressing the special learning requirements of talented students is adaptive learning. Teachers have mentioned the advantages of personalized learning and improved academic performance while discussing their positive experiences using adaptive learning in their classes. Adaptive learning, like any educational technology, comes with a number of challenges and drawbacks. Technology obstacles must be overcome in addition to pedagogical challenges, such as switching to new learning modes and time management. Additionally, there are administrative and psychological difficulties, such as issues with how platform resources should be organized and how to make sure that gifted students are engaged in and motivated by adaptive learning.

An interesting finding of this study was that all teachers recognize the importance of using adaptive learning tools in conjunction with traditional active learning methods, rather than viewing them as a replacement for each other. This is an important perspective, as it recognizes the value of combining the strengths of both approaches to create a more effective and engaging learning environment for students. Active learning, which involves engaging students in activities that promote critical thinking, problem-solving, and collaboration, has been shown to be effective in improving student outcomes (Freeman et al., 2014). However, active learning can be time-consuming and may not always accommodate the diverse needs of all students. On the other hand, adaptive learning tools can provide personalized instruction and allow students to work at their own pace, but may lack the interactivity and engagement of active learning (Taylor, Yeung & Bashet, 2021).

This study found that teachers employ various strategies to integrate adaptive learning into their instruction successfully. This is important because it emphasizes the difficulty of incorporating technology into the classroom. The strategies include several organizational, pedagogical, class management, curriculum, instruction, and technological approaches that reflect the complexity of teaching and learning and indicate that a holistic strategy is necessary for the effective integration of adaptive learning. This result also emphasizes the value of teacher support and training, as it is obvious that teachers require various abilities and expertise to use adaptive learning tools efficiently. Educators and policymakers can better support and arm teachers in their efforts to use technology to improve student results by understanding the techniques that teachers employ to implement adaptive learning (Chai, Koh & Tsai, 2010).

Teachers perceive several benefits of adaptive learning, including personalization of student learning, promotion of student-centered learning, and positive impacts on student experience, engagement, and motivation. It implies that adaptive learning has the potential to

alter established traditional teaching methods and enhance student performance. Additionally, adaptive learning can make learning more available to students with a variety of learning needs and preferences by streamlining the learning process. This is important because adaptive learning's potential to make learning more available to students with different learning needs and preferences is crucial in ensuring educational equity. Because students with different learning styles and aptitudes are taught in the same manner using traditional teaching methods, some students may fall behind or become disinterested. Contrarily, adaptive learning can tailor each student's learning experience to meet their unique requirements and preferences by offering them individual feedback, resources, and activities (Wang et al., 2020). Students who struggle with particular concepts can benefit from extra support and direction while those who pick up concepts easily can move on to harder material (Taylor, Yeung & Bashet, 2021). Personalized learning technology can advance equity in education by meeting each student's unique learning requirements (Roberts-Mahoney et al., 2016).

The finding that adaptive learning can enhance metacognition - the capacity to evaluate and control one's own learning - is also especially significant because metacognitive abilities are crucial for success in both academic and non-academic contexts (Cortese, 2022). Teachers can improve the personalized, effective, and engaging learning environment that supports student achievement by utilizing adaptive learning tools (Taylor, Yeung & Bashet, 2021). The results highlight how adaptive learning has the potential to enhance student learning outcomes and indicate that more research in this field is necessary.

The study also highlights important concerns among teachers regarding the potential impact of adaptive learning on human interaction and relationships in the classroom. Some teachers express concerns that the use of technology and adaptive learning tools may replace human interaction, including the relationships between teachers and students, as well as

among students. These concerns are valid, as research has shown that positive teacher-student and student-student relationships are critical to student engagement, motivation, and academic success (Xerri, Radford & Shacklock, 2018). Teachers provide more than just content knowledge; they also serve as role models, mentors, and sources of emotional support for their students. Similarly, peer relationships can provide social and emotional support for students and enhance their sense of belonging in the classroom community.

Teachers also seem to struggle to implement adaptive learning in their classes due to a lack of training and limited technology resources. This is not surprising, but it does highlight a significant barrier to the efficient use of technology in education. Teachers may find it challenging to incorporate adaptive learning tools into their teaching successfully practices without access to the required technology and training, which may limit the potential benefits of these tools for students. This finding emphasizes how crucial it is to close the digital gap and give teachers the tools and assistance they require to use technology in the classroom successfully (Chai, Koh & Tsai, 2010). By investing in technology resources and training programs, educators and policymakers can help ensure that teachers have the tools and knowledge necessary to leverage technology to improve student learning outcomes (Camilleri & Camilleri, 2017).

5.3 Teachers' Approaches to Implementing Adaptive Learning in Gifted Education

The use of digital tools in the educational process has significantly altered how both teachers and students approach learning (Morze, et al., 2021). Various strategies and techniques in implementing adaptive learning in gifted education were identified during the interviews. Teachers highlighted that with the help of adaptive learning platforms they can tailor lessons and assignments according to student’s strength and weaknesses. This strategy has grown in popularity among teachers since it offers students a special chance to learn at their own pace, improving their abilities and all-around academic achievement.

Teachers note that adaptive learning has the potential to give students chances to learn outside of the conventional classroom setting and to get them ready for exams and Olympiad competitions. Teachers also believe that using adaptive learning to evaluate their students' learning and development is a good idea. This result is significant because it highlights the advantages of personalized learning experiences for students outside of the classroom, which can boost their motivation and involvement in the learning process. Additionally, using adaptive learning to prepare students for exams and Olympiads can increase their knowledge of the subject matter and increase their chances of success. Gifted schools helped students feel highly competent and effective in their academic endeavors by giving them access to a stimulating learning atmosphere marked by a rigorous curriculum, high academic standards, and the expectation that they compete in academic Olympiads (Almukhambetova & Hernández-Torrano, 2020).

As a tool for assessment, adaptive learning can also give teachers useful information that they can use to personalize their instruction and better understand student learning. Adaptive learning platforms can give teachers useful data they can use to personalize their instruction and promote student learning by tracking a student's progress and highlighting areas of strength and weakness (e.g., Taylor, Yeung & Bashet, 2021).

The vast majority of survey participants believed that while adaptive learning may have some advantages, there are also issues with its efficacy and potential effects on the learning environment. More specifically, teachers found that using adaptive learning had a number of drawbacks, which emphasizes some of the difficulties that teachers encounter when integrating this technology into the classroom. According to the findings, the majority of participants thought that managing adaptive learning programs could be challenging, that academic integrity and cheating were serious issues, that it could be difficult to align adaptive

learning with the curriculum, that too much screen time could be harmful to one's health, and that the teacher's role in the classroom might be affected.

Academic integrity and cheating are two major issues associated with the application of adaptive learning. Students may have access to knowledge and resources never before possible thanks to AI technology, for instance “ChatGPT is capable of writing lines of code, producing plays, stories, poetry as well as simulated scientific content such as abstracts” (Alberts et al., 2023, p.1). This can be a severe problem because it compromises the academic system's credibility and diminishes the accomplishments of honourable students. Therefore, while implementing adaptive learning in the classroom, it is crucial to have mechanisms in place to stop cheating and preserve academic integrity.

The potential negative effects of excessive screen time and the need for a balance between screen time and other pursuits are first and foremost well supported by empirical research (Przybylski & Weinstein, 2017). Excessive screen time has been associated with a variety of cognitive and developmental problems in children and teens, such as delays in language development, attention deficits, and a lower capacity for forming relationships with others (reference). Finding a balance between screen time and other activities is essential for maintaining good health and wellbeing.

Moreover, according to the More Knowledgeable Other (MKO) theoretical paradigm (Vygotsky, 1978), a teacher is an essential source of information, direction, and support for students as they learn new concepts and abilities. The instructor has traditionally served as the main MKO in the classroom, dispensing knowledge and instructing students.

However, the function of the teacher is gradually shifting as a result of the introduction of novel methodologies like adaptive learning. With the aid of algorithms,

adaptive learning systems can tailor each student's learning experience, changing the course's pace, difficulty level, and content to suit their individual needs.

Given this situation, it makes sense to assume that the conceptualization of the MKO will change in the near future as a result of the introduction of AI into the classroom. While teachers will always be essential in guiding and assisting students, AI-based technologies will also act as MKOs by giving each student individualized teaching and feedback. As a result, educators will need to modify their methods of instruction and embrace technological advancements in the classroom. They may be required to explore innovative ways to incorporate AI-based systems into their lessons and how to use the data these systems provide to improve their methods of teaching. Teachers will also need to gain more confidence in their ability to serve as mentors and facilitators in the classroom rather than serving as the primary source of information. In order to encourage students to cooperate and learn from one another as well as from the teacher and AI-based systems, they must create a helpful and cooperative learning environment.

These findings highlight the importance of carefully weighing the possible disadvantages of adaptive learning before introducing this technology into the classroom. This is significant because it emphasizes the need for educators and policy makers to carefully consider the advantages and disadvantages of using flexible learning in the classroom.

5.4. Summary

This chapter portrayed the various findings on the teachers' perception, strategies, benefits, challenges, drawbacks and opportunities of implementing adaptive learning in the classroom. In summary, the previous discussion illustrates that adaptive learning has the potential to personalize student learning, improve student engagement and motivation, and simplify learning. However, the challenges identified by teachers, such as limited technology

resources, concerns about academic integrity and cheating, and health issues related to excessive screen time, must be addressed to fully realize the benefits of adaptive learning. The discussion reveals the importance of investing in technology resources and training programs for teachers, as well as further research and development of adaptive learning tools. It offers an explanation on the benefits and drawbacks of adaptive learning from the perspective of teachers, and highlights the need to address these concerns to ensure the effective use of technology in education. The endeavor of analyzing the findings was to produce a comprehensive understanding of the benefits and challenges of adaptive learning in the classroom, and to inform future efforts to improve student learning outcomes. This chapter offered insights into the potential benefits and drawbacks of adaptive learning and the need to address the concerns of teachers to ensure its effective use in the classroom. In the next chapter, we will discuss potential solutions and strategies for addressing the challenges identified in this chapter and maximizing the potential benefits of adaptive learning in gifted education.

6. Conclusions

Within this chapter, the study's final conclusions are presented, in addition to its implications, limitations, and recommendations for future research. Eight teachers participated in semi-structured interviews using Microsoft Teams where they discussed their experiences using adaptive learning. The study identified that teachers have multiple conceptualizations, saw different benefits, strategies and opportunities, and experienced some challenges and noticed some drawbacks. All participants expressed positive experiences using adaptive learning technology for teaching and learning and would advise other educators to use it. The chapter is organized into five sections. The first section presents the research questions and provides answers based on the study's findings. It also evaluates the extent to which the study contributes to the understanding of the research problem. The second section discusses the practical implications of the study. The third section highlights the study's strengths and limitations. Specifically, it discusses possible avenues for expanding the sample size, utilizing different research methods, or addressing alternative research questions. The fourth section provides recommendations for future research based on these aspects. Finally, in the fifth section, a concluding statement is provided that summarizes the most relevant findings and implications of the thesis.

6.1 Revisiting Research Questions

This particular case study aimed at exploring teachers' experience with adaptive learning in gifted education and was guided by following research questions:

- RQ1 How do NIS teachers conceptualize adaptive learning in gifted education?
- RQ2 What are NIS teachers' experiences with adaptive learning in gifted education?
- RQ3 How do NIS teachers approach the implementation of adaptive learning in gifted education?

6.1.1. How do NIS Teachers Conceptualize Adaptive Learning in Gifted Education?

This research question aimed to explore how NIS teachers conceptualize adaptive learning in gifted education. The findings suggest that some teachers may equate personalized learning with adaptive learning, while others may define it as individualization, and a few may place special emphasis on the contribution of technology to personalized learning experiences. These various conceptualizations have significant effects on how adaptive learning is implemented and supported in gifted education, emphasizing the necessity of continual communication and cooperation between educators, researchers, and adaptive learning platform makers. The study found that NIS teachers had a range of perspectives on the potential use of adaptive learning in non-gifted education in addition to conceptualizations of adaptive learning in gifted education. Adaptive learning was regarded to be beneficial for all students by some teachers, but gifted students may benefit more from it due to their special learning requirements and skills.

Additionally, there were a variety of viewpoints about the subjects in which adaptive learning might be used. Some educators believed it could be used to all subjects, but others thought it may work better in STEM fields because of the increased focus placed on problem-solving, critical thinking, and creativity in these fields. The interview also discovered that teachers thought adaptive learning was a way to increase student motivation, engagement, and autonomy. To ensure that the technology is used effectively and in alignment with the pedagogical goals and priorities of the school or district, there must be clear communication and collaboration among educators, administrators, and platform developers. This is made clear by the diversity of viewpoints regarding the objectives and advantages of adaptive learning.

6.1.2. What are NIS Teachers' Experiences with Adaptive Learning in Gifted Education?

It was found through this study that adaptive learning technology serves as a beneficial tool for digital teaching and learning purposes. By utilizing adaptive learning technology, students were empowered to take charge of their own learning and were able to independently evaluate, correct, and review course material at their convenience, even beyond the boundaries of the classroom. The promotion of student engagement and facilitated learning was achieved through personalized learning, immediate feedback, frequent content review, and explanations for incorrect responses. Efficient monitoring of student engagement and progress can be achieved through visualizing student performance and progression data. This data was utilized to direct tutoring sessions, identify and monitor at-risk students, and provide additional support to those in need.

However, this study also revealed several challenges and drawbacks with adaptive learning. There were concerns that the new technology would replace conventional teaching methods and reduce human connection in the classroom. Some teachers and students also found it challenging to adjust to the personalized learning approach and the new technology. The study also revealed the possibility of problems with academic integrity when employing adaptive learning technology. Teachers should carefully plan and supervise the use of adaptive learning technologies and set clear standards for student behaviour and academic integrity in order to address the concerns. These challenges and drawbacks imply that, even though adaptive learning technology can be an effective tool for teaching and learning, it is crucial to carefully assess its deployment and its effects on teachers and students.

6.1.3. How do NIS Teachers Implement Adaptive Learning in Gifted Education?

This research question has revealed that teachers see a variety of opportunities to using this strategy. The opportunity to prepare students for national academic competitions

and/or Olympiads, the possibility for personalization in the education of highly gifted students are two of the most significant prospects that teachers are aware of. These results imply that adaptive learning can be a useful tool for assisting gifted students' academic progress and that teachers may have varied priorities and aims when it comes to putting this strategy into practice.

Opportunities provided by adaptive learning for gifted children go beyond individualised instruction and competitive preparation. The ability to design a more dynamic and personalised learning environment is a key benefit of adaptive learning. Many times, gifted individuals have particular learning demands that might not be sufficiently met in a regular classroom context. With the aid of adaptive learning tools, students can work through the material at their own pace and concentrate on the areas in which they need the most assistance.

Additionally, adaptive learning may present gifted children with additional assessment opportunities. The platform includes an option that shows how the goal was achieved and a progress diagram that displays which stage each student is at. The system also monitors the number of attempts a student makes before answering correctly, which can help identify students who need additional support. Additionally, the function tracks the time spent on assignments, allowing teachers to intervene if a student struggles with a particular task. Based on the results, this feature can help teachers identify which students require feedback and support to improve their academic performance. Students who demonstrate stable growth may not require special assistance, while those who experience fluctuations in their progress require additional attention from their teacher.

6.2 Implications for Theory and Practice

The research focused on exploring teachers’ experience with adaptive learning in gifted education. The research findings have contributed to better understanding of how

adaptive learning is perceived by teachers and how it is implemented in gifted education, as well as how it aligns with the theoretical predictions suggested by Vygotsky, the More Knowledgeable Other (MKO) and Mishra and Koehler, Technological Pedagogical Content Knowledge (TPCK) theories, adaptive learning is seen as a way to support and enhance student learning outcomes by providing personalized instruction and feedback. Vygotsky (1978) argued that through engagement with an MKO students can acquire information and skills above the current level of development. Mishra and Koehler (2006) claimed that teachers need to integrate technology into their teaching practice. According to Vygotsky (1978) social interaction and collaboration with people who are more knowledgeable and skilled than the learner promotes learning. This study found that teachers see adaptive learning as a tool to give students personalized learning and assist them in acquiring knowledge and skills, and these findings are consistent with Vygotsky's theory. According to Mishra and Koehler's (2006) TPCK theory, teachers should include technology into their teaching if they want to teach effectively. According to this particular study findings, which are also consistent with TPCK theory, teachers view adaptive learning as a tool to improve their teaching methods and boost students' learning outcomes.

The study contributes to the literature on gifted education by examining the application of adaptive learning in this area. According to this research, adaptive learning may be a practical method for addressing the special requirements and difficulties faced by gifted children. Personalized learning experiences, differentiation, increased motivation, and student engagement are all made possible via adaptive learning. Our knowledge of how technology can be used to enhance gifted education and meet the needs of gifted students is thus expanded by the study.

There are numerous implifications of the study for practice and policy. First, school leaders should think about how adaptive learning could promote student learning outcomes in

gifted education. Additionally, they should make sure that adaptive learning initiatives support the MKO and TPCK frameworks as well as the institution's pedagogical objectives and top priorities. Second, teachers can use the study's findings to help them better understand how to include adaptive learning into their classroom practises. To be capable of successfully integrating technology in the classroom, teachers need to have access to professional development opportunities. They must know how to make use of adaptive learning tools to differentiate instruction, promote motivation and engagement among students, and personalise learning experiences. Finally, this study suggests that NIS leadership take into account testing adaptive learning for non-STEM subjects. The data imply that adaptive learning can be utilised successfully in areas other than STEM, although though it is currently only employed in NIS for STEM subjects. The effectiveness and applicability of adaptive learning for promoting student learning outcomes in these areas can be assessed by conducting a pilot programme in non-STEM courses.

In conclusion, the study’s findings provide that adaptive learning can be valuable tool for teacher to implement personalized instruction and enhance student learning outcomes in gifted education. The findings contribute to better understanding of how adaptive learning is perceived and implemented by teachers, and how it aligns with theoretical framework in the field of educational psychology and learning theory.

6.3 Limitations and Strength of the Study

There are several limitations of this particular study. Firstly, the study excludes the opinions of students, parents, and administrators in favor of concentrating entirely on the experiences and perceptions of teachers regarding adaptive learning in gifted education. Due to the possibility that various stakeholders have varying perspectives on and experiences with adaptive learning, this constraint may have an impact on the validity and generalizability of the findings. Secondly, teachers of STEM subjects made up the study's sole sample, so the

results might not accurately represent the experiences and viewpoints of a larger population. Therefore, the validity and generalizability of the findings could be impacted by this. Thirdly, the study's qualitative design may limit its ability to make causal inferences or generalize findings to a larger population. It might be challenging to draw generalizations or make predictions about the success of adaptive learning in gifted education since qualitative research frequently employs small sample numbers and concentrates on participants' subjective experiences.

This study has several strengths that should be recognised. Firstly, the study is focused on the use of adaptive learning in gifted education. Since adaptive learning technologies have the potential to improve the educational experiences of gifted children, this field is of great interest. Children who are gifted frequently have special learning requirements, and standard school settings might not provide them the chance to realise their full potential. This problem can be solved by using adaptive learning technologies, which provide a more individualised method of training that can be adjusted to meet the needs of each individual learner.

The study's qualitative research approach, on the other hand, enables a thorough and in-depth examination of teachers' experiences with and opinions of adaptive learning in gifted education. Investigating complex and nuanced issues in educational settings is a good use for this methodology. Thirdly, the case study methodology of the study enables a thorough examination of a particular setting, which might offer insightful information about the application and use of adaptive learning in gifted education. A broad and in-depth understanding of the experiences of teachers in this situation can also be obtained using the case study method. Fourthly, since teachers are so important to the implementation and application of adaptive learning in gifted education, the study's emphasis on teachers' experiences and perceptions is a crucial strength. The results of the study can help in the

creation of efficient, professional development programs and assistance for instructors in this field. For educational practitioners, policymakers, and researchers interested in the application and usage of adaptive learning in gifted education, the study's findings may also have practical significance. The findings of the study can be used to build efficient adaptive learning programs and regulations that cater to the demands of gifted children.

6.4 Future Research

Future research on this topic has a number of potential directions. First, to develop a more thorough knowledge of the application and usage of adaptive learning in gifted education, future research might investigate the experiences and perspectives of various stakeholders, such as gifted students, parents, and administrators. This study could also be extended by studying the non-STEM subject teachers' perspectives, for instance, humanitarian subject teachers as English language teachers or History teachers. This would allow seeing the full picture of the advantages and disadvantages of adaptive learning. To provide a more thorough knowledge of the efficiency of adaptive learning in gifted education, future studies might use a mixed-method approach that combines qualitative and quantitative research methods. This strategy might also make it easier to establish links between adaptive learning and successful student outcomes. Future studies should look at how various adaptive learning technologies and methods affect the learning outcomes for gifted students as well as the perceptions and experiences of teachers. Overall, the creation of successful and fair educational practices can be further informed by future research in a number of areas connected to adaptive learning in gifted education, which can build on the knowledge from this study.

6.5 Summary

The purpose of this qualitative study was to explore the experience of teachers with adaptive learning in gifted education. Participants shared their experiences with adaptive

learning during a semi-structured interview. The audio component of the interviews was recorded. The study revealed several relevant findings. The findings showed that teachers' conceptions of adaptive learning varied, which affected how they applied the strategy. While some compared individualization with adaptive learning, others defined it as personalization, and a few highlighted the role that technology plays in creating personalized learning experiences. These conceptualizations had a big impact on how adaptive learning was used and supported in gifted education, emphasising the importance of ongoing collaboration and communication between educators, researchers, and the developers of adaptive learning platforms. Teachers value adaptive learning's individualization and personalization features and think all students, not just gifted ones, may benefit from them. In addition, teachers believe that adaptive learning can be efficient in any subject, while others claim that it can be used in STEM subjects only.

Teachers also identified a few challenges associated with implementing adaptive learning in gifted education. Limited technology resources and a lack of training were a few of the difficulties mentioned by the teachers. Others included worries about academic integrity, issues with curriculum alignment for adaptive learning, potential health problems associated with excessive screen time, and worries about how adaptive learning would affect the role of the teacher in the classroom. Additionally, some teachers voiced worries about the possibility that adaptive learning will take the place of interpersonal communication and the value of preserving teacher-student and student-student interactions in the classroom. These difficulties point to the necessity for continued support and professional development for teachers in the use of adaptive learning, as well as careful assessment of any potential downsides and difficulties.

While challenges exist in implementing adaptive learning in the classroom, teachers identified several successful strategies for incorporating it into their teaching. Teachers have

used adaptive learning as a tool for providing targeted support to struggling students, and providing personalized learning experiences to all students. Furthermore, teachers have reported that adaptive learning has allowed them to differentiate instruction and provide individualized support to gifted students, enabling them to excel academically and achieve their full potential.

The collected data indicated that adaptive learning facilitated independent student learning and provided opportunities to prepare for national academic competitions and Olympiads. Teachers highlighted digital content, supportive learning based on data-driven insights, and personalized learning experiences as the most significant benefits of adaptive learning.

Overall, the study highlights the potential benefits of adaptive learning in gifted education and the importance of providing teachers with adequate training and support to ensure effective implementation. Additionally, the study highlights the need for continued research and development to optimize the use of adaptive learning in gifted education and to address the challenges associated with its implementation.

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Appendices

Appendix A *Consent form*

INFORMED CONSENT FORM (for teacher participants)

Teachers' experience with adaptive learning in gifted education: a qualitative case study in schools for gifted students in Kazakhstan

DESCRIPTION:

You are invited to participate in **a research study** on analysing the experiences the teachers in gifted education go through when using adaptive learning. You are being invited to participate in this research because your experience as a member of school teaching team can contribute to our understanding and analyzing of teachers' experiences with adaptive learning.

You will be asked to participate in a one-on-one interview with your permission to record it. Your confidentiality will be protected, since your real name will not be used in any research report derived from this study, only pseudonyms. Moreover, the recorded interviews will be deleted after transcribing the interviews. During the analysis process only the supervisor and the researcher will have an access to the data. As the process of interviewing starts you will have an opportunity not to answer any of the questions that you will find not appropriate.

TIME INVOLVEMENT: Your participation will take approximately 60 minutes.

RISKS AND BENEFITS:

Risks concerning your personal and professional life for you as a result from participating in this research are minimal. Your name or any personal information that could identify you will not be reported in any research report derived from this study. Only the researcher will know the coding schema that will be used to substitute real names of the participants. All the information collected on this study will be stored information on a password-protected

personal computer of the researcher. However, during conducting the interview there may be some minor risks concerning the time that you will spend for the interview, as you will be interrupted from your everyday activities. From these considerations, it is up to you when and where to appoint the meeting for the interview, the researcher will try to fit in with your plans.

A possible advantage is the professional development of the teacher through participation in the study. Participation in the study will allow you to make an analysis of your teaching practice, and perhaps will help you to further reveal your potential as a teacher. 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: If you have read this form and have decided to participate in this project, please understand your **participation is voluntary** and you have the **right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled**. **The alternative is not to participate.** You have the right to refuse to answer particular questions. The results of this research study may be presented at scientific or professional meetings or published in scientific journals.

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 for this student work, daniel.torrano@nu.edu.kz Dr. Daniel Hernández-Torrano

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

Statement of consent

The researchers clearly explained to me the background information and objectives of the study and what my participation in this study involves. I understand that my participation in this study is voluntary. I can at any time and without giving any reasons withdraw my consent, and this will not have any negative consequences for myself. I understand that the information collected during this study will be treated confidentially.

□ I am willing to participate in this research

□ I do not wish to participate in this research

□ I am willing to be audio recorded

□ I do not wish to be audio recorded

Signature: _____ Date: _____

The extra copy of this signed and dated consent form is for you to keep.

ҚАТЫСУШЫЛАРДЫҢ АҚПАРАТТЫ КЕЛІСІМ ФОРМАСЫ (мұғалім қатысушылар үшін)

Дарындыларға арналған мектептердегі бейімдеп оқытумен мұғалімдердің тәжірибесі: Қазақстандағы дарынды оқушыларға арналған мектептердегі сапалы кейс-стади.

СИПАТТАМАСЫ:

Сіздерді бейімдеп оқытуды пайдалана отырып, дарынды балаларды оқыту саласындағы мұғалімдердің тәжірибесін талдайтын зерттеуге қатысуға шақырамыз. Сізді осы зерттеуге қатысуға шақырамыз, себебі сіздің мектебіңіздің педагогикалық ұжымының мүшесі ретіндегі тәжірибеңіз бейімдеп оқыту саласындағы мұғалімдер тәжірибесін түсінуімізге және талдауымызға ықпал етуі мүмкін.

Аудио жазуға рұқсатыңызбен сізден жеке сұхбатқа қатысу сұралады. Сіздің жеке өміріңіз қорғалады, өйткені сіздің шын атыңыз осы зерттеуден алынған ешбір зерттеу есебінде пайдаланылмайды, тек бүркеншік аттармен ғана қолданылады. Сонымен қатар, жазылған сұхбаттар сұхбат транскрипциясынан кейін жойылады. Талдау барысында деректерге тек жетекші мен зерттеуші ғана қол жеткізе алады. Әңгімелесу процесі басталған кезде сіз орынсыз деп санайтын сұрақтардың ешқайсысына жауап бермеу мүмкіндігіне ие боласыз.

ӘҢГІМЕНІҢ ҰЗАҚТЫҒЫ:

Сіздің қатысуыңыз шамамен 60 минутты алады.

Тәуекелдер мен артықшылықтар:

Осы зерттеуге қатысу нәтижесінде сіздің жеке және кәсіби өміріңізге төнетін тәуекелдер аз. Сіздің атыңыз осы зерттеуден алынған ешбір зерттеу есебінде көрсетілмейді. Қатысушылардың шын есімдерін ауыстыру үшін қолданылатын кодтау

схемасын зерттеуші ғана біледі. Осы зерттеуден жиналған барлық ақпарат тергеушінің құпия сөзбен қорғалған дербес компьютерінде сақталады. Дегенмен, сұхбат кезінде сұхбатқа қанша уақыт жұмсайтыныңызға байланысты шамалы тәуекелдер болуы мүмкін, себебі сіз күнделікті әрекеттеріңізден алшақтайсыз. Осы ойларға сүйене отырып, сұхбатқа қашан және қайда кездесуге болатынын өзіңіз шешесіз, зерттеуші сіздің жоспарларыңызға сәйкес келуге тырысады.

Артықшылығы – зерттеуге қатысу арқылы мұғалімнің кәсіби дамуы. Зерттеуге қатысу сіздің педагогикалық тәжірибеңізге талдау жасауға мүмкіндік береді, мүмкін мұғалім ретінде сіздің әлеуетіңізді одан әрі дамытуға көмектеседі. Зерттеуге қатысу ешқандай сыйақыны қарастырмайды.

Сіздің осы зерттеуге қатысу-қатыспауыңыз мектептегі жұмысыңызға әсер етпейді.

ҚАТЫСУШЫНЫҢ ҚҰҚЫҚТАРЫ: Егер сіз осы форманы оқып, осы зерттеуге қатысу туралы шешім қабылдасаңыз, **қатысуыңыз ерікті екенін** және **кез келген уақытта айыппұлсыз және кез келген артықшылықтарды жоғалтпай келісіміңізді қайтарып алуға немесе қатысуыңызды тоқтатуға құқығыңыз бар екенін түсінуіңіз керек. Немесе сіз зерттеуге қатыспауды таңдай аласыз.** Сіз сондай-ақ сұрақтарға жауап бермеуге құқылысыз. Бұл зерттеудің нәтижелері ғылыми немесе кәсіби мақсаттар үшін ұсынылуы немесе жариялануы мүмкін.

БАЙЛАНЫС АҚПАРАТЫ:

Сұрақтар: Егер сізде осы зерттеуге, оның тәртібіне, тәуекелдері мен артықшылықтарына қатысты сұрақтарыңыз, пікірлеріңіз немесе шағымдарыңыз болса, сіз келесі ақпаратты пайдалана отырып, зерттеуші жетекшісіне хабарласа аласыз: daniel.torrano@nu.edu.kz Доктор Дэниел Ернандез-Торрано

Тәуелсіз байланыстар: Егер сіз осы зерттеудің жүргізілуіне қанағаттанбасаңыз, қандай да бір мәселелер, шағымдар немесе сұрақтарыңыз болса, Назарбаев Университеті Жоғары білім беру мектебінің зерттеу комитетіне +7 7172 70 93 59 телефоны арқылы хабарласа аласыз немесе gse_researchcommittee электрондық поштасына хат жібере аласыз. gse_researchcommittee@nu.edu.kz

Келісім туралы мәлімдеме

Зерттеушілер маған зерттеудің негізгі ақпараты мен мақсаттарын және осы зерттеуге қатысуым нені қамтитынын нақты түсіндірді. Бұл зерттеуге қатысуым ерікті екенін түсінемін. Мен кез келген уақытта және ешқандай себепсіз келісімімді қайтарып ала аламын және бұл мен үшін ешқандай теріс салдар тудырмайды. Осы зерттеу барысында жиналған ақпарат құпия түрде қарастырылатынын түсінемін.

□ Мен бұл зерттеуге қатысуға дайынмын

□ Мен бұл зерттеуге қатысқым келмейді

□ Аудио жазуға дайынмын

□ Аудио жазуды қаламаймын

Қолы: _____ Күні: _____

Ақпаратты келісімнің қол қойылған бір данасы сізде сақталады.

ФОРМА ИНФОРМАЦИОННОГО СОГЛАСИЯ

(для учителей участников)

Опыт учителей с адаптивным обучением в школах для одаренных: качественный кейс стади в школах для одаренных учащихся в Казахстане

ОПИСАНИЕ:

Приглашаем вас принять участие в исследовании, посвященном анализу опыта, который испытывают учителя в области обучения одаренных детей при использовании адаптивного обучения. Вас приглашают принять участие в этом исследовании, потому что ваш опыт работы в качестве члена школьного педагогического коллектива может способствовать нашему пониманию и анализу опыта учителей в области адаптивного обучения.

Вам будет предложено принять участие в собеседовании один на один с вашим разрешением на запись. Ваша конфиденциальность будет защищена, так как ваше настоящее имя не будет использовано ни в каком исследовательском отчете, полученном из этого исследования, только в псевдонимах. Кроме того, записанные интервью будут удалены после расшифровки интервью. В процессе анализа только руководитель и исследователь будут иметь доступ к данным. Когда начинается процесс собеседования, у вас будет возможность не отвечать ни на один из вопросов, которые вы сочтете не подходящими.

ДЛИТЕЛЬНОСТЬ ИНТЕРВЬЮ:

Ваше участие займет около 60 минут.

Риски и преимущества:

Риски, связанные с вашей личной и профессиональной жизнью для вас в результате участия в этом исследовании, минимальны. Ваше имя не будет указано ни в одном отчете об исследовании, полученном из этого исследования. Только исследователь

будет знать схему кодирования, которая будет использоваться для замены реальных имен участников. Вся информация, собранная по данному исследованию, будет храниться на защищенном паролем персональном компьютере исследователя. Тем не менее, во время проведения собеседования могут быть некоторые незначительные риски, связанные с тем, сколько времени вы потратите на собеседование, так как вас отвлекут от вашей повседневной деятельности. Исходя из этих соображений, вам решать, когда и где назначить встречу для интервью, исследователь постарается соответствовать вашим планам.

Возможным преимуществом является профессиональное развитие учителя посредством участия в исследовании. Участие в исследовании позволит Вам сделать анализ своей практики преподавания, и возможно, поможет Вам еще глубже раскрыть свой потенциал как учителя. Участие в исследовании не предусматривает каких-либо вознаграждений. Ваше решение участвовать в этом исследовании или нет, не повлияет на вашу работу в школе.

ПРАВА УЧАСТНИКА: Если Вы прочитали данную форму и решили принять участие в данном исследовании, Вы должны понимать, что **Ваше участие является добровольным** и **что у Вас есть право отозвать свое согласие или прекратить участие в любое время без штрафных санкций и без потери какой - либо возможной выгоды для Вас. В качестве альтернативы можно не участвовать в исследовании.** Также Вы имеете право не отвечать на какие-либо вопросы. Результаты данного исследования могут быть представлены или опубликованы в научных или профессиональных целях.

КОНТАКТНАЯ ИНФОРМАЦИЯ:

Вопросы: Если у Вас есть вопросы, замечания или жалобы по поводу данного исследования, процедуры его проведения, рисков и преимуществ, Вы можете связаться

с руководителем исследователя, используя следующие данные:

daniel.torrano@nu.edu.kz Доктор Дэниел Ернандез-Торрано

Независимые контакты: Если Вы не удовлетворены проведением данного исследования, если у Вас возникли какие-либо проблемы, жалобы или вопросы, Вы можете связаться с Комитетом Исследований Высшей Школы Образования Назарбаев Университета по телефону +7 7172 70 93 59 или отправить письмо на электронный адресgse_researchcommittee@nu.edu.kz

Заявление о согласии

Исследователи четко объяснили мне исходную информацию и цели исследования, а также то, что включает в себя мое участие в этом исследовании. Я понимаю, что мое участие в этом исследовании является добровольным. Я могу в любой момент и без объяснения причин отозвать свое согласие, и это не будет иметь для меня никаких негативных последствий. Я понимаю, что информация, собранная в ходе этого исследования, будет рассматриваться как конфиденциальная.

□ Я готов(а) участвовать в этом исследовании

□ Я не хочу участвовать в этом исследовании

□ Я хочу, чтобы меня записывали на аудио

□ Я не хочу, чтобы меня записывали на аудио

Подпись: _____ Дата: _____

Одна подписанная копия информационного согласия хранится у Вас.

Appendix B. *Sample Letter to the Gate Keeper*

Dear _____,

My name is Saltanat Mukhamadiyeva and I'm currently conducting a research project for my Master's degree at Nazarbayev University.

I'm writing to ask your permission to be allowed access to your school and can be conducted at a convenient time and date to be arranged. All I will need is to arrange a suitable time to interview some teachers involved in Adaptive Learning.

The purpose of this study is to explore teachers' experiences using adaptive learning approaches in gifted education in NIS schools in different parts of Kazakhstan. More specifically, this study aims to identify opportunities, challenges, strategies, benefits, and drawbacks of adaptive learning that teachers are experiencing and/or have experienced.

All answers and results from the research are kept **strictly confidential.** If this is possible please could you send my email to all your teachers if they are willing to participate in my study.

If teachers are willing to participate in my study, I want teachers to contact me at saltanat.mukhamadiyeva@nu.edu.kz

Thank you for your time and I hope to hear from you soon.

Yours faithfully

Saltanat Mukhamadiyeva

Nazarbayev University, Graduate School of Education, Educational Leadership

Құрметті _____,

Менің атым Салтанат Мухамадиева, мен қазір Назарбаев Университетінде магистратурада ғылыми жобаны жүргізіп жатырмын.

Мен сіздің мектебіңізге зерттеу жүргізу мақсатында кіруге рұқсат сұрау үшін жазып отырмын. Маған қажет нәрсе - бейімді оқытуға (adaptive learning) қатысатын кейбір мұғалімдермен сұхбаттасу үшін қолайлы уақытты ұйымдастыру.

Бұл зерттеудің мақсаты – Қазақстанның әртүрлі аймақтарындағы НЗМ мектептерінде дарынды білім беруде бейімді оқыту тәсілдерін қолдану арқылы мұғалімдердің тәжірибесін зерттеу. Нақтырақ айтқанда, бұл зерттеу мұғалімдер өз тәжірибелерінде көрген бейімді оқытудың (adaptive learning) мүмкіндіктерін, қиындықтарын, стратегияларын, артықшылықтары мен кемшіліктерін анықтауға бағытталған.

Барлық жауаптар мен зерттеу нәтижелері **қатаң құпияда сақталады**.

Егер мұғалімдер менің зерттеуіме қатысуға дайын болса, мұғалімдерге осы хатты жіберуіңізді сұраймын.

Егер мұғалімдер менің зерттеуіме қатысқысы келсе, мұғалімдердің saltanat.mukhamadiyeva@nu.edu.kz электронды мекенжайы бойынша хабарласуын сұраймын.

Уақытыңыз үшін рахмет және сізден жақын арада хабар аламын деп үміттенемін.

Құрметпен,

Салтанат Мухамадиева

Назарбаев Университеті, Жоғары білім беру мектебі, Білім берудегі көшбасшылық

Уважаемая _____,

Меня зовут Салтанат Мухамадиева, и в настоящее время я провожу исследование для получения степени магистра в Назарбаев Университете.

Я прошу Вашего разрешения на доступ к вашей школе для того, чтобы провести интервью. Все, что мне нужно, — это договориться о подходящем времени, чтобы провести интервью с некоторыми учителями, участвующими в адаптивном обучении.

Целью данного исследования является изучение опыта учителей в адаптивном обучении в обучении одаренных детей в школах НИШ в разных частях Казахстана. В частности, это исследование направлено на выявление возможностей, проблем, стратегий, преимуществ и недостатков адаптивного обучения, с которыми сталкиваются и/или сталкивались учителя.

Все ответы и результаты исследования **строго конфиденциальны**.

Если это возможно, прошу Вас отправить мое письмо вашим учителям, если они согласны участвовать в моем исследовании.

Если учителя согласны принять участие в моем исследовании, они смогут связаться со мной по электронному адресу saltanat.mukhamadiyeva@nu.edu.kz

Спасибо за ваше время, и я надеюсь услышать от вас в ближайшее время.

С уважением,

Салтанат Мухамадиева

Назарбаев Университет, Высшая школа образования, Лидерство в образовании

Appendix C. *Interview questions*

Research Questions	**Data Collection Tool**	**Sample questions/ items**	**Data analysis**
Demographic and background questions Демографиялық және фондық сұрақтар Демографические и справочные вопросы	Interview Сұхбат Интервью	1. What language would you prefer for our interview, Kazakh, Russian, or English? 2. How long have you been working as a teacher? 3. What is your pedagogical level? (teacher, moderator and so on) 4. What city is your school in? 5. What subject do you teach? 6. How did you get involved in teaching adaptive learning to gifted students in this school? 7. Did you have any prior adaptive learning experience	

		before coming to this school? 8. Do you have any specific professional training on adaptive learning or a related approach? 1. Сұхбатымыз үшін қазақ, орыс немесе ағылшын тілдерінің қайсысын қалайсыз? 2. Мұғалім болып жұмыс істегеніңізге қанша уақыт болды? 3. Сіздің педагогикалық деңгейіңіз қандай? (мұғалім, модератор және т.б.) 4. Мектебіңіз қай қалада? 5. Сіз қандай пәннен сабақ бересіз? 6. Осы мектепте дарынды оқушыларды бейімді оқытуға қалай қатыстыңыз?	

		7. Осы мектепке келгенге дейін сізде бейімд оқыту тәжірибесі болды ма? 8. Бейімді оқыту немесе соған байланысты көзқарас бойынша қандай да бір арнайы кәсіби дайындық бар ма? 1. Какой язык вы бы предпочли для нашего интервью, казахский, русский или английский? 2. Как долго вы работаете учителем? 3. Каков ваш педагогический уровень? (учитель, модератор и др.) 4. В каком городе находится ваша школа? 5. Какой предмет вы преподаете? 6. Как вы вовлечены в преподавание АО одаренным ученикам в этой школе?	

		7. Был ли у вас опыт адаптивного обучения до прихода в эту школу? 8. Есть ли у вас какая-либо специальная профессиональная подготовка по АО или родственному подходу?	
RQ1: How do Kazakhstani teachers conceptualize adaptive learning in gifted education? 1 зерттеу сұрағы: Қазақстандық мұғалімдер дарынды білім берудегі бейімді оқытуды қалай тұжырымдайды? Вопрос исследования 1: Как казахстанские	Interview Сұхбат Интервью	1. There's a lot of talk about what adaptive learning (AL) is and isn't. What is AL for you? 2. What are the main characteristics of AL? 3. What are some differences between AL and other learning approaches you have implemented in your teaching experience? 4. Do you see AL as something a whole school should adopt or a program that only some students could do? 5. Why do you think the school decided to introduce AL?	

учителя понимают АО в обучении одаренных?		1. БОдың не екені туралы көп айтылады. Сіз оған қандай анықтама берер едіңіз? 2. БО-дың негізгі сипаттамалары қандай? 3. Оқыту тәжірибеңізде енгізген БО және басқа оқыту тәсілдерінің арасында қандай айырмашылықтар бар? 4. Сіз БО-ды бүкіл мектеп қабылдауы керек бағдарлама немесе кейбір оқушылар ғана орындай алатын бағдарлама деп санайсыз ба? 5. Неліктен мектеп БОды енгізуді шешті деп ойлайсыз? 1. Много говорят о том, что такое АО а что не является АО. Что для вас АО?	

		2. Каковы основные характеристики АО? 3. Каковы некоторые различия между АО и другими подходами к обучению, которые вы применяли в своей преподавательской деятельности? 4. Считаете ли вы АО чем-то, что должна внедрить вся школа, или программой, с которой могут справиться только некоторые ученики? 5. Как вы думаете, почему школа решила ввести АО?	
RQ2: What are teachers' experiences with adaptive learning in gifted education? 2 Зерттеу сұрағы: Дарынды білім беруде	Interview Сұхбат Интервью	1. What is, in your opinion, the best thing about AL? 2. In your experience, what are the benefits of AL for gifted students?	

бейімделген оқыту бойынша мұғалімдердің тәжірибесі қандай? Вопрос исследования 2: Каков опыт учителей в области адаптивного обучения в сфере образования для одаренных?		3. Do you think AL could be beneficial also for non-gifted students? 4. How does adaptive learning impact gifted students' academic outcomes? In your experience, do ed-tech products enable students to acquire knowledge more effectively than traditional teaching methods? 5. What about other outcomes? Does AL have a positive influence on student motivation? What about their relationships with other students? 6. Do you believe students and teachers may lose contact as a result of independent student work? 7. What is the biggest drawback/disadvantage of AL, in your view?	

		1. Сіздің ойыңызша, БО туралы ең жақсы нәрсе не? 2. Тәжірибеңізде дарынды оқушылар үшін БО-дың қандай пайдасы бар? 3. Сіздің ойыңызша, БО дарынды емес оқушылар үшін де пайдалы болуы мүмкін бе? 4. БО дарынды оқушылардың оқу нәтижелеріне қалай әсер етеді? Сіздің тәжірибеңіз бойынша, ed-tech өнімдері оқушыларға дәстүрлі оқыту әдістеріне қарағанда білімді тиімдірек алуға мүмкіндік береді ме? 5. Басқа нәтижелер туралы не деуге болады? БО оқушылардың мотивациясына оң әсер ете ме? Олардың басқа оқушылармен қарым-қатынасы туралы не деуге болады?	

		6. Студенттердің өзіндік жұмысы нәтижесінде студенттер мен мұғалімдердің байланысы үзілуі мүмкін деп ойлайсыз ба? 7. Сіздің ойыңызша, БО ең үлкен кемшілігі қандай? 1. Что, по вашему мнению, самое лучшее в АО? 2. По вашему опыту, каковы преимущества АО для одаренных учащихся? 3. Считаете ли вы, что АО может быть полезен и для неодаренных/обычных учащихся? 4. Как АО влияет на академические результаты одаренных учащихся? По вашему опыту, позволяют ли продукты образовательных технологий учащимся приобретать знания	

		более эффективно, чем традиционные методы обучения? 5. А как насчет других результатов? Оказывает ли АО положительное влияние на мотивацию учащихся? А как насчет их отношений с другими учениками? 6. Считаете ли вы, что студенты и преподаватели могут потерять контакт в результате самостоятельной работы студентов? 7. Каков, на ваш взгляд, самый большой недостаток АО?	
RQ3: How do teachers approach the implementation of adaptive learning in gifted education?	Interview Сұхбат Интервью	1. How easy is it to use an AL approach in your classroom? 2. Can you describe a typical lesson when you use adaptive learning? How many students can participate? Do they work individually or in groups? What students are asked to do? How long	

3 Зерттеу сұрағы: Дарынды білім беруде бейімдеп оқытуды енгізуге мұғалімдер қалай қарайды? Вопрос исследования 3: Как учителя подходят к реализации адаптивного обучения в системе обучения одаренных детей?		does an AL session take, approximately? 3. What subjects (maths, science, etc.) do you think can be taught using AL? Can AL be used to t each other subjects(e.g., English, History)? Why? 4. What challenges have you faced when AL was implemented at your school? Can you provide an example of a moment when you met some challenges implementing AL? 5. What kind of skills are required to teach using AL? Are there any special training or program development teachers need to go through to be effective users of AL? 6. Are there any strategies you would like to share with colleagues who will use AL in the future?	

		1. Сыныпта БО әдісін қолдану қаншалықты оңай? 2. БОды қолданған сабақты сипаттай аласыз ба? Қанша оқушы қатыса алады? Олар жеке немесе топпен жұмыс істей ме? Оқушыларға қандай тапсырма беріледі? БО уақыты шамамен қанша уақытты алады? 3. БОды пайдалана отырып, қандай пәндерді (математика, жаратылыстану, т.б.) оқытуға болады деп ойлайсыз? Бейімделетін оқытуды басқа пәндерді (мысалы, ағылшын тілі, тарих) оқыту үшін пайдалануға болады ма? Неліктен? 4. Сіздің мектебіңізде БО енгізілген кезде қандай қиындықтарға тап болдыңыз? Сіз	

		БО енгізу кезінде кейбір қиындықтарға тап болған сәттің мысалын келтіре аласыз ба? 5. БО қолдану арқылы оқыту үшін қандай дағдылар қажет? БО тиімді пайдалана алу үшін мұғалімдерге арнайы дайындық немесе бағдарлама дамыту дайындығы керек пе? 6. Болашақта БО қолданатын әріптестеріңізбен бөліскіңіз келетін стратегиялар бар ма? 1. Насколько легко использовать подход АО в вашем классе? 2. Можете ли вы описать типичный урок, когда вы используете АО? Сколько учеников могут участвовать? Они работают индивидуально или в группах? Что требуется от учащихся? Сколько примерно времени занимает сеанс АО?	

		3. Как вы думаете, какие предметы (математика, естествознание и т. д.) можно преподавать с помощью АО? Можно ли использовать АО для преподавания других предметов (например, английского языка, истории)? Почему? 4. С какими проблемами вы столкнулись при внедрении АО в вашей школе? Можете ли вы привести пример момента, когда вы столкнулись с некоторыми трудностями при внедрении АО? 5. Какие навыки необходимы для обучения с использованием АО? Есть ли какое-либо специальное обучение или программа развития, которую должны пройти учителя, чтобы быть эффективными пользователями АО?	

		6. Есть ли какие-то стратегии, которыми вы хотели бы поделиться с коллегами, которые будут использовать АО в будущем?	

Appendix D. *Coding*

Category	Themes	Quotations
Conceptualization	**C 1** Personalization	- Well, in simple words, to say what adaptive learning means to me, it's an individual setting for a particular student, about certain criteria for the level of knowledge on what kind of emotional state of the child. And then this is an individual adjustment, adjustment to the student, in order to approach or realize a particular goal. **P1** It is difficult to give an exact definition. This is an individual approach to each student, a personalized approach, that is, each student has a development trajectory, creating conditions at different levels related to each student's personal route. Thus, the student will have a development trajectory that is independent of anyone, according to his abilities, and the direction will play the role of a guide **P5** We can't say that we are fully mastering AL, we are still in the process of mastering. Of course there will be changes, for example we have had different teaching methods, be it CLIL or other active learning methods. This adaptive learning has its own characteristics. For example, student-centered learning enables the student, the teacher prepares before the lesson, and the student works more during the lesson. We can say that it had a good influence on our experience, that is, it influenced the students to develop their abilities as much as possible, to work according to their own abilities, not only to receive information from the teacher, not to limit themselves. **P5** For example, if we take an individual subject, it can be said that it is a specific education tailored for each student using his own knowledge, that is, using what that student knows. For example, for the pace of that student, the student may be a more able student or a less able student, may be a fast student or a slow student, that is, I think it is adaptive teaching so that there is a route for an individual student.**P6** One of the advantages of adaptive teaching is that the student is given a certain amount of time, he knows how to use that time, but he must achieve the given goals. The student chooses the way to achieve the goals.**P6**

	C 2 Personalization with technology	- well, adaptive learning, we have learning directly in the classroom or outside the classroom, with the help of some platform that has theoretical material, where the student himself can go in his free time, learn on his own. He will have his own route and can get graded on this platform. He can choose what to study. Active, it's when he's in the classroom, and all this happens in their active form, like learning, discussing, working in groups, games, decisions. **P2** I haven't read about adaptive learning beforehand. I realized something by using Canvas, ALEKS. Adaptive learning is learning in which students learn and prepare on their own, and when the teacher gives them a little direction, students help themselves to be themselves. Because we provide students with important information during school hours, they can look at assignments from home, re-read what they don't understand, and develop independently.**P7** In adaptive learning, information the students need and the goals are written down. Adaptive education takes place only in our upper classes and is conducted in English. If the student's level of English is low, he can read the materials from the lower class in Kazakh and recall them again.**P7**
	C 3 Individualization	- For me, adaptive learning is to give maximum knowledge, develop, skills, thinking, taking into account the student's abilities, level, potential and personality, individual character, approaches, studying the student as a certain person. Find the level in which he is comfortable. **P3** (she mentioned home-schooling as an adaptive learning) I don't have a deep knowledge of adaptive training because I haven't attended any specific adaptive training courses. Adaptive teaching, in my opinion, is the use of different methods according to the abilities of children. Maybe. Children are different kinesthetic, auditory, visual, some can understand theoretical material only by listening. Some will understand by showing the video. Maybe in that direction. **P4** In my opinion, adaptive learning is a situation and an opportunity created by the teacher, taking into account the needs and capabilities of the student, to effectively implement the learning process, to achieve the learning goal. **P8**

		The main characteristics of my current lessons are that the student has the opportunity to learn independently, and the teacher can provide resources. Teacher can monitor the progress of the student, and if there are any obstacles in the learning process of the student, the offered learning materials will be changed accordingly.**P8**
	C 4 For gifted sts only	
	C 5 For all sts	-I am absolutely convinced that it is possible under the right conditions, with properly created or selected learning platforms, namely, which will enable us to implement this adaptive learning, then – it is possible. **P1** - Well, in fact, adaptive learning is suitable for everyone, that is, each student can go through and find their own material. That it can be in the form of videos, it can be video games, app and so on. So, I think it will be useful for everyone. **P2** - Well, I think it's for everyone. Everybody should have equal opportunities. I think it would be good for everyone, but it will be effective for the gifted. **P3** Since it is a program proposed by managers of the development of education after conducting special studies, we do not immediately show a negative attitude. However, since our goal is to develop the field of education, it is necessary to use this AL. I think there will be good points. It takes some time, both students and teachers need to learn. All advantages and disadvantages should be seen and used.**P5** I think it is useful, because each student works according to his ability, that is, I think that the main problem is to get all students to work at the same time. For example, if a difficult material is presented, students with high ability will master it and become interested in it, while students with low ability and level may lose motivation after seeing such a task. And at this time, I think that we will have the opportunity to work according to the interests of all students according to their ability and level through AL. AL platforms allow timely monitoring of the progress of each student. **P5** Any student can study. Because according to the Arizona professor who taught us in the course, they have a lot of students with adaptive learning. If we say that we have 10-20 thousand students, then they have a

		lot of students. When asked how they teach so many students, the professor replied that they teach using adaptive learning platforms. The teacher directs students through the platform. But students finish the program at different times, one student may study for 1 year, while another student may study for 4 years. I think that it is possible to work with teaching adapted to all students.**P6** A self-directed learning approach is very useful. A student who says he doesn't study doesn't study with any program, but our students achieved their educational goals and received diplomas under this program. However, gifted students reach their learning goals faster. Even though less able students spent more time on all assignments, they met their learning goals. **P6** Adaptive learning will be convenient for upper class students. For example, if we start from 10th grade, it is convenient for 10-11-12 students. In order to have adaptive teaching in the lower grades, the teacher will need to do more monitoring. By entering the site, the teacher can monitor the progress of the students, the students of the upper class understand that this is all the information they need, and do it for themselves. And lower grade students need more control, because they may forget, the level of responsibility is still lower. And it is not necessary to separate the level of the student, it is necessary to teach adapted to all students. The difference is only in those lower or higher grade students. In the lower grades, the teacher will have to do more work. **P7** For such gifted students, tailored instruction will not be enough. I believe that adaptive learning is for general students. For excellent students, the tasks and learning objectives here only cover what they need to learn and do not delve into it further. Therefore, this adaptive learning will not be enough for gifted students. I think it would be better for teachers to work with such students individually. **P7** Of course, it is useful, because there is a special algorithm for it, the information is given step by step. Children can see where they stand, see what direction they should work. The teacher also teaches according to the student's ability. But here, with non-gifted children, the teacher helps to realize the potential of other children, depending on the learning goals, through the

		support of the teacher or the zone of proximal development. Gifted education is offered to students of all grades, but special attention is given to students who are not gifted. Then, for example, when I give tasks in advance, when we come to class, we fix the topic and do practical work. At that time, the teacher can see which child has learned well or where questions have arisen. Allows you to see which students need what support. Students will have the opportunity to gradually develop working skills. **P8**
	C 6 Any subject in AL	- you can use adaptive learning for, in my opinion, for any subject, if you combine it, let's say, in some other way, but for example, as we now use adaptive active, because, in my opinion. probably, no subject will be able to 100% switch to adaptive learning. **P1** - Well, of course, the subject of the natural science is better suited. For humanitarian subjects, this is also possible, why, because there can also be online resources, Internet resources, video resources, and at the end the student can do the task on them. And on this side, the only disadvantage will be that there will be no skill, such as, for example, speaking. Our languages are divided according to several skills. These are reading, speaking, listening, writing. If it is possible to test and improve reading, listening and writing on an active system, speaking is not affected there. **P2** It is possible if all materials and theoretical information are included there. For example, there are various skills in English, if they are fully covered, I think there is a possibility if there is necessary theoretical information. **P4** It is convenient to apply to subjects in the direction of natural sciences. It can also be used for language classes, if the learning objectives of the program are included. It would be convenient for teachers. **P7**
	C 7 STEM subjects only	- I think that AL is more suitable for the physical and mathematical direction. Because it's important for the humanities, it's important to talk about situation analysis, and you have to pay more attention to information analysis, to communications, and I think it's more suitable for the exact sciences. **P3** It is possible to integrate all subjects, although it is often more effective and suitable for subjects in the natural sciences. In those lessons, students can enter specific answers. Exact numerical responses can be evaluated.

		Short written responses are also accepted. I think it's more difficult for other language subjects. **P5** Generally ALEKS is a platform for mathematics and chemistry. I think it is possible to teach science subjects. For example, lessons such as biology and geography. Language classes need to talk, maybe another skill can be developed, but when it comes to speaking, if it's like a robot talking to a student on a platform, that's fine. **P6**
	C8 PD is needed	But if we talk about some theoretical aspects in general, what adaptive learning is, how it can be used in the classroom, not all teachers know, and therefore the courses, some special, should be organized precisely theoretical in nature, some basic, such moments are needed. **P1** I'm not sure I understand the AL well. **P3** we have a TEAMS support group where we, teachers who work in the AL to help and give advice. Then there's the manager who directs. **P3** For me, the disadvantage is that students and teachers still do not fully understand AL. The organizer explained to us that we, the teachers, still need support. Courses are still needed to successfully organize AL entirely in the classroom. **P5** I was told that teachers who have not taken the course do not teach with adaptive learning. Our school is taking courses. Now I am studying the 3rd part of the course, I found out that there are other platforms. I am learning the difference between self-directed learning and active learning. I believe that teachers should undergo a special course. For example, I am teaching with a Canvas. I'm studying the capabilities of Canvas. It was preceded by personalized training, that is, it differs from adaptive learning. In the summer, for example, I took another course, which was about active-adaptive learning. At that time, they taught the differences between personalization and differentiation, how it differed from differentiation. That is, it is necessary to pass the course. **P8**
	C9 PD isn’t needed	- To be honest, I don't think that we need any special programs, because if it is some kind of platform, then on each platform there are introductory works, where everything is explained, where there are some buttons, where how

		you use this form. So, we're all literate people, I don't think anybody is going to have that moment. **P1** And if we talk about the platforms there is nothing so global and supernatural, complex there. **P1** I think any teacher can use it if they have enough academic knowledge. I don't think it will take him long if he prepares for thirty minutes in advance, compiles and checks the tasks, and also studies the necessary information from the inside. It does not cause difficulties for the teacher. Only in terms of time, you may not be able to fully master the goals, otherwise it will not be a problem.**P4** If the teacher is well skilled in information technology, I don't think any special training is needed. All you have to do is know your subject and information technology. When we started working with the ALEKS platform, many functions were unknown, we looked at each of those functions and learned everything inside within 1 month. **P6** In my opinion, there is no need for professional training. If the teacher knows English fluently, can fully work with a computer, then there is no need for special training. Everything is convenient and easy to understand. **P7**
	C10 Implementation reason	-Since we know that this is how adaptive training allows us to implement personalized learning, individualization of learning. Because adaptive learning is to adapt to a particular student with some knowledge, already with some, let's say, skills and abilities. So, of course, since we work for the student, we must first of all think about how to create comfortable conditions for a particular student, and adaptive learning allows us to do this. The second point, which is also important, is the simplification of the process for both the student and the teacher. A lot of students are more comfortable working independently. The result is immediately visible and the trajectory of the student's development is immediately visible.**P1** - Well, in general, now the trend of education is, of course, the spheres of adaptive education, personalized learning, inclusion in education. Therefore, we did not have such a platform, and according to the strategy, we began to work in this direction. We began to create our own platforms, like NIS online, NIS LAB - this is

		virtual laboratory work, virtual work, virtual subjects and including adaptive-active learning. **P2** - Well. I think because we expect from this greater efficiency, better performance and to prepare successful students who tomorrow will make themselves more loyal, more competitive, more creative, critically thinking. **P3** In my opinion, gradual development of methodical and pedagogical experience of teachers, easy delivery of knowledge to students, that is, independent research and analysis of students, increase of general knowledge.**P4** As far as I know, the terminology used at the University of Arizona is the use of artificial intelligence due to the development of the times. With the help of artificial intelligence, it is an auxiliary tool for both the teacher and the student, and it is aimed at improving the quality of education. Studies have shown that the quality of education has increased by using these technologies, methods, and platforms. I think that's why they use it.**P5** First of all, I think the situation during the COVID was the impetus. For example, during covid, students went to distance learning. Then the schools considered various aspects of distance learning. At first, teachers thought online teaching was impossible. Students of secondary schools are also preparing for UNT through many online courses. Online learning has become one of our daily activities. The school should be ready for such news. I think that it is necessary to be ready for any problem of the world, and for that reason, they have switched to adaptive training.**P6** This tendency has not been applied to all intellectual schools in teaching. It is being conducted only in some schools. It is succeeding. One of the main reasons is that if this student prepares more on his own, without being too dependent on the teacher, he will watch, prepare and improve his performance on his own free time. After that, if we conduct online classes, adaptive learning method will be very necessary. I'm talking about the two platforms I used (ALEKS & Canvas), I haven't tried other platforms.**P7** The reasons for adopting adaptive learning are that each school has its own mission and vision, for example, teacher and student should work together to become a

		successful person, ready for lifelong learning. I think that it was introduced in order to realize the talent and ability of a gifted student. For example, the subjects of physics, chemistry, and biology are introduced in intellectual schools. I think that in the future it will allow them to focus on the subject and develop professional specialties of students. That's why, even if it is an experimental platform and it is being tested, I believe that adaptive learning will find its support further after teachers share their experience and demonstrate their achievements. I believe that the reason for its introduction is the implementation of programs based on the best practices of the world. That's why I believe that because adaptive learning is developing in the education field of developed countries, they are implementing the curriculum for the purpose of adaptive active learning of students without causing problems. And as a teacher, even though I have 22 years of experience, this is new for me, for me, adaptive learning is a useful thing, because there are students who study on their own during the lesson, there are children who are ahead of other children, who want to learn more than what the teacher gave during the lesson. there are also children. I believe that it is being implemented with such a purpose. I support this. **P8**
Challenges	**CH 1** Internet	In the second, it's technical equipment. If we imagine that several, let's say, classes at once, that is, the whole parallel sits down and works on adaptive learning, this is firstly the speed of the Internet, respectively, the child can no longer work so quickly and clearly in the platform. **P1** Secondly, it is not possible to qualitatively conduct because of ICT possibility of it. That is, we have the Internet lagged, our tablets weren't ready for this platform.**P2** We used it through the platform, through Canvas, where sometimes the technique doesn't work properly, because of the internet or the laptop, sometimes the materials are difficult. That is, organization is not easy for the teacher **P5**
	CH 2 Device	It's, of course, even somewhere the same headphones or the same, let's say, operating systems, if they're outdated, we won't be able to implement. Here's one problem that, let's put it mildly, our computers didn't quite pull the adaptive platforms.**P1** Secondly, it is not possible to qualitatively conduct because of ICT possibility of it. That is, we have the

		Internet lagged, our tablets weren't ready for this platform.**P2** We used it through the platform, through Canvas, where sometimes the technique doesn't work properly, because of the internet or the laptop, sometimes the materials are difficult. That is, organization is not easy for the teacher**P5** Difficulties in general are registration from the first time, and as for the actual adaptation technology, it is not being able to properly plan the time, time management. After that, the adaptive learning technology itself is successful in some lessons and not in others. The lesson also depends on the students. What I have encountered in my own experience is that some topics are not fully revealed on the platform, some topics are redundant, there is a lot of material. Malfunction of equipment, presence of technical defects. All this affects the lesson. **P5**
	CH 3 Teaching	And thirdly, we can also name the doubts of the teachers, because, when the teacher is young, he understands that he is good at learning the adaptive platform. When the teacher is older, it is more difficult for him to adapt and, in any case, will avoid the use of the adaptive system in the classroom. Only because of the requirements he will begin to do this in the classroom.**P2**
	CH 4 Management	- Well, the most important thing, let's say, the difficulty was the transition from the old to the new for me personally, and for the students I am sure too, because our students are used to the fact that we have an ordinary combined traditional lesson.**P1** First of all, time, proper use of time, we spent a long time when we brought gadgets or laptops and gave tasks through the canvas. There will be difficulties in achieving goals. Six lessons a week would not be enough time to cover all the objectives. Children pass the SAU SAT, and the frequent use of the canvas is difficult to pass.**P4** Difficulties in general are registration from the first time, and as for the actual adaptation technology, it is not being able to properly plan the time, time management. After that, the adaptive learning technology itself is successful in some lessons and not in others. The lesson also depends on the students. What I have encountered in my own experience is that some

		topics are not fully revealed on the platform, some topics are redundant, there is a lot of material. Malfunction of equipment, presence of technical defects. All this affects the lesson. **P5** But at first they did not complete the tasks on time. Because of this, some students had to accumulate tasks according to learning objectives. That is, if the student does not complete the assignments on time, there will be many assignments. It is visible to the teacher on the platform. At first, the student did not fully understand the importance of this.**P7**
	CH 5 Curriculum	We used it through the platform, through Canvas, where sometimes the technique doesn't work properly, because of the internet or the laptop, sometimes the materials are difficult. That is, organization is not easy for the teacher **P5** Difficulties in general are registration from the first time, and as for the actual adaptation technology, it is not being able to properly plan the time, time management. After that, the adaptive learning technology itself is successful in some lessons and not in others. The lesson also depends on the students. What I have encountered in my own experience is that some topics are not fully revealed on the platform, some topics are redundant, there is a lot of material. Malfunction of equipment, presence of technical defects. All this affects the lesson. **P5**
	CH 6 Additional workload	It will be more convenient to use if there is an electronic device, a laptop or gadgets that children have. And if the students don't have such devices, it puts an additional burden on the teacher, that is, I have to bring a laptop, I have to check that the laptops are working, and it puts a burden on me. This will be an extra job.**P4**
	CH 7 Professional development)	
	CH 8 Motivation	And I also wanted to mention the motivation of students, because, as I said, first of all, this is a departure from the traditional, from something ordinary to something new. Accordingly, not all students and not all teachers, let's say, are motivated to this. It was hard for me to get motivated. **P1**
	CH 9 Platform	But technically there were some problems on the site, **P3**

		As for the AL in general, the only drawback that I can think of right now is that the platform materials should be selected correctly. We have learning objectives to provide the student with the necessary skills, and for that, the materials should be well selected and properly organized. This is because the student spends time and energy in the process of mastering the material, and in the end, he should get the necessary knowledge and the necessary skills. I think it should meet that requirement.**P5**
Opportunities	**O 1** Enhance learning	-The best thing about adaptive learning is that here the student sees his pace, sees his progress instantly, and I think this is the most important thing he knew, he can control his pace. **P1** Then the platform, i.e. artificial intelligence, will find out the weak and strong points of the student by giving tasks on various topics. More tasks are prepared for the aspects of the student that he does not know.**P6** Unlike traditional teaching, students often seek help from the teacher. It is limited to certain resources, the textbook. And there are opportunities for students to acquire knowledge in adaptive learning. Therefore, adaptive learning not only develops subject knowledge, but also allows to develop certain skills. They even have the opportunity to take certain topics and deepen their interests in the future. I believe that it is necessary to influence the educational process in a positive way. I think it will show itself in the future.**P8**
	O 2 Support content	
	O 3 Student engagement	I think that traditional teaching is one-way teaching. Self-confidence of the student increases through adaptive teaching. They start looking for different tasks more and more, they see that there are different types of tasks. That is, I think that adaptive teaching is a very good method. **P6** The student's activity is dominant. Thirdly, the student can consider ways to improve his studies, get support and direction from the teacher. That is, the student can monitor his progress. And now active learning methods are not used in traditional teaching, it can be said that the resources offered to students are the same, standard for students. **P8**

	O 4 Learning environment	Even now it is useful for students. Sometimes students miss classes, sometimes they get sick, or they go to competitions, and then the student looks at the learning goals and can go into that Canvas, see what information needs to be read, what needs to be known, and prepare for the summative work.**P7**
	O 5 Learning pace / self-regulation	-- The best thing about adaptive learning is that here the student sees his pace, sees his progress instantly, and I think this is the most important thing he knew, he can control his pace. **P1** But at the same time, he will be responsible for his own answer for his result.**P1**
	O 6 Olympiad prep	What I liked the most was that I had students in some classes who were very talented, and I would give them the topic in advance, and they would study it beforehand. Accordingly, I was preparing complex Olympiad tasks for them. Then those students studied several topics and won an award in the national and online Olympiads. This is one advantageous side.**P4** It is said that if a person is born with talent but does not work, he will not have a chance to develop his talent. The teacher, giving direction, allows the student to develop in a certain direction. For example, I have an olympiad student in computer science and he will soon go to an international competition. Then that child learned my subject by working on his own. I have the opportunity to learn the program beforehand with that child. And this child completed the term summative assessment earlier than other children and is going to go to the training seminar according to the plan, but he mastered the program in advance. Or. It gives the children participating in the Physics Olympiad a great opportunity to master the theoretical program on their own and see their achievements. **P8**
	O 7 Immediate feedback	
	O 8 Personalization	
	O 9 Assessment	- Actually, there is such a function, there is a tick that goes to the student how the goal was achieved. Then there's the progress of the students, it shows in the form of a diagram who, at what stage. There's also a function, with how many times he answered, that is, if you did 3 times and his answer was correct only the third time, it means that this student needs help. It's a function on time, that is, how much each student spent time on each

		assignment. And if you see that one student is there on a certain task, then the teacher can come to help him. Well, according to the results, you can also, probably, those who show stable growth do not need special help for them, and those who, on the contrary, have an increase and decline, for them the teacher should give feedback, come up to ask from this side.**P2**
Strategies	**S 1** Class management	Often, students bring a laptop, so we perform various virtual laboratory works through the laptop, through the link.**P4** In my opinion, it is necessary to introduce adaptive learning gradually. Because every child, every student has certain possibilities. I believe that it is necessary to enter children who need to go beyond a certain circle. Because it is a great opportunity for gifted students and the teacher to develop the skills of certain students. Perhaps it depends as much on teacher preparation as it does on teacher access to resources. Of course, it depends on the number of students. Because I teach 5 classes, the number of students in those 5 classes is less than 60. And now there are 30 children in one class of mainstream schools. In that case, I think it can cause problems for teachers. **P8** I believe that the teacher should always monitor. Difficulties are encountered, some children need to be watched. Some children need to be given instructions, some children go ahead on their own. Some students are working on additional information by finding mistakes.**P8**
	S 2 Content	In my opinion, it is necessary to introduce adaptive learning gradually. Because every child, every student has certain possibilities. I believe that it is necessary to enter children who need to go beyond a certain circle. Because it is a great opportunity for gifted students and the teacher to develop the skills of certain students. Perhaps it depends as much on teacher preparation as it does on teacher access to resources. Of course, it depends on the number of students. Because I teach 5 classes, the number of students in those 5 classes is less than 60. And now there are 30 children in one class of mainstream schools. In that case, I think it can cause problems for teachers.**P8**
	S 3 Assessment	
	S 4 Organization	They have headphones that they also use and nobody doesn't bother them.**P1**

		They work really individually. And in terms of time, as I have already said about the purpose of the task and the volume, maybe from 5 and go 20 minutes. **P1** - I don't know if this can be called a strategy, but first of all, be positive and take everything, let's say, with ease and see only the good in what you do This is not done to make life difficult for us. This is done only to facilitate the activities of our and the student.**P1** Organization of students, individual sitting of students. Learning to work on the platform, watching, trying to use all the features of the platform. Then, if the students don't know, let the students work in pairs, for example, make students with different assignments work together, and then work individually. For example, two students sit at two computers, but the tasks are different, but the topics are the same.**P6** I have not tried adaptive learning for 40 minutes during the lesson. When planning, I don't use it for the whole lesson, I switch to other teaching methods. This is because the teacher himself has a functional role, according to the program. I think it should be a certain amount. In order to develop certain skills, it is necessary to use them in moderation.**P8**
	S 5 Individual work	That's why we're trying to combine adaptive active learning so that students understand that they're not isolated.**P1** Students do not work in groups, they work individually. It is very convenient to work with a group, so I will not say that we have stopped using group work at all. When working in a group, the student can ask the children in the group what he does not know, and complement each other, but he should also take along those who work individually. Some information may be understood further if the student reads and understands it at home. The pace of the students during the lesson is different, some take it quickly, some take it slowly. We work at an average pace during class. Therefore, students can review the materials themselves from home. **P7**
	S 6 Platform choice	Because we're combining adaptive with active, but on the other hand, we need to approach the chosen platform very competently. If we choose a wrong platform for adaptive learning, then it will be a one-side disadvantage. **P1**
	S 7 Teaching	the learning goals, what is the purpose of training, if the purpose of training, of course, is practical, then adaptive

		learning can be applied only either at the beginning of the lesson So that children look, assess their level of theory or check their knowledge **P1** there are a huge number of different approaches, to the fact that you can use a flipped class, Yes, and children already let's say so, having studied the theory and having worked out all the practical tasks of Adaptive learning with the adaptive method Sometimes they already come prepared, you only, let's say, check and how much they have learned it, AL works more as a homework assignment, a self-control task, a consolidation task. **P3** Strategy... Since we have a physics subject, I take a reflection after each lesson. I don't like some of my lessons, I like some of my lessons, but nevertheless, because it's physics, it has to be consistent with natural phenomena. Often, if we perform demonstration and laboratory work often in various fields, the student can understand physics in depth. And in the future, every physics lesson, I think we should add more demonstration and laboratory work. We need to develop students' application skills - this is my future strategy.**P4** Many things should be taken into account, the teacher must have fully mastered all the material in the first AL program, when to use which part, when to study in depth, to give feedback to each student, to evaluate and monitor the success of each student, so it is the teacher's primary responsibility.**P5** It was very difficult during that period, I think it will be difficult. I think that maybe with increasing experience, over time, it will be easier for a teacher who has completely transferred to AL. And for the teachers who have some problems because we are currently using the AL on a trial basis. **P5** Yes, I have some small suggestions. The first teacher should experience and study what is AL itself. Teachers should have an understanding of the advantages of AL, why it is being developed now, and why it is being used. Then do a little research on how to use it in your subject. In general, it depends on how AL is implemented, if AL is on a platform, it is better to understand the curriculum and working principles of that platform. **P5**

		A good feature of our intellectual schools is that the teacher not only develops himself, but also creates an opportunity for the discussion of other teachers. I believe that in the future I will have researches like action research on the problems encountered during adaptive teaching. For example, the problems I am thinking about are how to monitor, how to support students, how to present information effectively. Your interview today still gave me a lot to think about.**P8**
	S 8 Technology	At the same time, in order to be prepared for this, say, for this change, which sooner or later we will still have to take it for granted, otherwise I would advise you to read the literature, to look at what platforms exist in general, see what studies have already been done in this area. That is, to be, shall we say, savvy and ready for these changes. **P1** In Canvas, there will be theoretical information for diligent students to study in advance, and I will ask them to look at and read that information, and I have created questions based on that. I give questions, according to the learner, the canvas is explained in very easy language, the theoretical material is fully covered, the students answered the questions without any difficulty.**P4** Yes, there is a relationship problem. Group and pair work may decrease, and individual work may increase. **D1** However, depending on the experience of the teacher, the form of organization of the lesson, the ability to carry out side-by-side learning, i.e. flipped learning, perhaps using the same technology or using other methods, it is necessary to pay attention to the correct socialization of students in the classroom, and the interaction.**P5** If the computer can be fully used by teachers, it will not be a problem. You enter the site of Canvas, login with a password, and then everything appears. To use Canvas and ALEKS, the teacher's English level must be good, because all the information is in English. If you know English well, it will not be a problem for the teacher. A teacher who does not know English will have problems and may not understand the information.**P7**
Benefits	**B 1** Acceleration	any adaptive platform only has a positive effect, because the student, again, does not do any, do not waste time and does not lose energy. **P1**

		And secondly, this is speed training, that is, they can take the course according to their abilities in a timely manner. That is, to finish in one month, in 2 months in 3 and so on regarding their abilities and, then move on to projects. **P2**
	B 2 Metacognition	And then I think the student relies more on himself, on how he has prepared, whether he has completed the level or not, what stages he has passed. I think he understands that if he has something there. didn't understand or didn't finish it. They're more conscious now, they know how to evaluate. **P3**
	B 3 Mastery-based learning	When it comes to real gifted students, we often try to use personalization in the materials prepared by the teacher. However, students may have different abilities and may not be completely satisfied with the materials. They want to know more. It is deeper, faster, at this time the technology of AL is useful because it does not hold back the student, but moves further, depending on his own pace, depending on his ability. **P5**
	B 4 Immediate feedback	The best thing about adaptive learning is that feedback is given to the learner. The student completes their task, and then when they get feedback, the platform gives them other tasks based on the topics they don't understand, so that they can look again at what they missed. **P**6
	B 5 Interaction	I don't think the connection will be broken. On the contrary, for example, the student asked the teacher what he did not understand. I don't think the relationship will be broken. The teacher knows the route of each student. The teacher knows which tasks he is working on or which tasks he failed to complete correctly, in which topics he has difficulty. The teacher can see how much time he completed the tasks. The student asks the teacher what he does not know. That is, the connection cannot be broken.**P6**
	B 6 Motivation	In order not to lose this spark, let's say, not to lose the motivation of these gifted children, we need to use adaptive learning **P1** -There is a type of student who, for example, likes to learn independently. Of course, it will affect the motivation of students. In class, students may often not listen to the teacher, maybe they may have a conflict. Maybe he is tired at this time, he is tired, he has not slept, and so on. And when he is given a chance to study himself and evaluate himself, it seems to motivate them.**P2** Still to be fully tested. Talented children that I have noticed over the course of a year are really interested in

		them. They perform different modules and topics faster than other students. That is, their motivation is maintained at the required level. What is important here is that the AL program, the set of materials should be properly selected and properly organized. Because there the student is learning and developing on his own, the teacher is watching, and I think that there should be the appropriate tasks to guide the talented student.**P5** When we first started adaptive learning, the students were not very interested, but then as a motivation, after receiving the certificate on the platform, the teachers praised the students at the board. They give certificates and even medals. The students who were looking at it tried to take the medals one by one, saying that "I had them too". This motivated the students. I had a student who didn't understand much of that medal, so he asked for help from other speedlearners. He performed with those students.**P6** It may not affect students' interaction, but it may affect their motivation. If we take our educational system, if the student gets a low grade according to the summative assessment, I think that he can prepare himself at home until the term summative assessment.**P7**
	B 7 Growth mindset	After that, additional information is sought, not limited to only one topic. If we consider another example as an integrated lesson, for example, it connects physics and chemistry, I think it connects other subjects and studies those topics in depth.**P4** Perhaps, at the time when the world is developing in that direction, there is a lot of information, and one of the abilities that students need from that information is to be able to take what they need, manage themselves autonomously, that is, learn to make decisions on their own, evaluate themselves, their level of education, their level of material mastery. I think that it is a skill that should be evaluated and know where one is weak and where one is strong, so it seems that the AL method will help develop this skill and evaluate oneself. This is because the personal achievements of each student are visible there.**P5** I have students who have studied the lesson very well and completed the tasks on this ALEKS platform very well, and they have not started very much on these tasks. Gradually, he became interested in such tasks. He studied the subjects he was studying at school in depth through ALEKS. ALEKS provided them with a variety

		of tasks. That is, I think that the platforms are wide and large-scale. A good side for gifted children.**P6**
	B 8 Learning environment	since we work for the student, we must first of all think about how to create comfortable conditions for a particular student, and adaptive learning allows us to do this. **P1** The gifted student feels like a fish in the water, is very comfortable. **P1** students can go to the platform at the time they want, and then maybe when they are free.**P2** Be able to evaluate students. For example, if I write homework on paper or give a presentation, one of the students may listen to me and the other may not. In this case, I cannot control who did it, you will have to ask individually. Through Canvas, I can see what percent of the students did it, where they went wrong, and all that through the platform. All tasks completed by students are visible to me. When using ALEKS, you can see which student has been sitting for how long, while in Canvas the time is not visible, but it shows how many percent he did correctly and where he went wrong. This side is convenient. Seeing individual students immediately without asking. You can work individually with students who have achieved a low percentage.**P7**
	B 9 Personalization	this is how adaptive training allows us to implement personalized learning **P1** and thirdly it's, of course, individuality, that is, they're going to choose the program that they're going to be trained in. **P2**
	B 10 Simplification of LT process	The second point, which is also important, is the simplification of the process for both the student and the teacher **P1** The best thing about adaptive learning is that all the resources are available. Everything is developed on this platform, I can see the success of students. Adaptation of tasks, that is, simplification or, on the contrary, deepening, depending on the performance of students. In the case of distance learning or if there is an absence due to health, they have the opportunity to carry out their studies. I think this is the success. I believe that teachers shared their experiences and contributed. **P8**
	B 11 Independent learning	A lot of students are more comfortable working independently. **P1**

		Yes, I can say that it is more effective. We live in an age of advanced technology. Students will find the traditional method of learning boring. If students are absent from class or other situations occur, students are encouraged to ask all the previous topics, and then we should use technology in the most advanced form. I think that the student should be able to study and prepare independently, regardless of whether he comes to class at any time or not. I think that the use of technology means reducing the work of teachers. **P7**
	B 12 Tracking the progress	The result is immediately visible and the trajectory of the student's development is immediately visible. **P1** They're going to show different results. For us, it's going to give us an analysis, that is, as students understand, how quickly they've mastered it, which group is lagging behind, which group of students is ahead and in general, this is as an example of online learning.**P2**
Drawbacks	**D 1** Interaction/Communication	Communication is lost, but here, let's say, on the other hand, active learning can come to the rescue. **P1** if we use only adaptive learning, then we can lose this contact here. student-student, teacher-student.**P1** And well, the disadvantage here is that there is no cooperation, there is no communication between students, that is, there he is alone, and in the classroom they are usually motivated by group work.**P2** and secondly, less communication, less emotion from students. **P3** Yes, there is a relationship problem. Group and pair work may decrease, and individual work may increase.**P5** And it can't provide a full teacher-student relationship. If we teach on the platform, if we teach at a distance, we cannot fully provide a live interactive relationship between the student and the teacher, so I think that we cannot completely transfer to AL.**P5** Yes, there is another side to it. It can affect the ability to speak. For example, I tried to implement the read write pair share method in my class. Reads a certain topic, then writes the main keywords, the main laws, details, and shares the result of reading with other children in the class. I think that here students should not only study

		independently, but exchange knowledge among themselves. Because it is necessary to develop the child's communication skills.**P8** To tell the truth, I have not thought about the disadvantages of adaptive teaching, but I think that there will be no communication between children. It would be better if the child works on his computer, shares with others and listens. **P8**
	D 2 Only stem subjects	
	D 3 Time	- The main thing is the lack of time. Even working on the platform, they were lagging behind and couldn't even connect. The disadvantage is, first of all, it's time - a lot of time is wasted, **P3**
	D 4 Health issues	The disadvantage is that the resources children are using are on the platform, that is, electronic tools. It affects their health, they should rest their eyes.**P8**
	D 5 Extra responsibility	
	D 6 Academic integrity	academic honesty will be present, why, because there is no control over them, they can use any resources, Internet resources. And we can't control that. So, the academic honesty here is on the students themselves **P2** - Well. The biggest disadvantage here is that you can call it academic integrity. And secondly, if we're talking about academic honesty, then someone else can pass it for another student. These results can be submitted by someone else every time, and you can't control it. That is, this, the truth will, of course, be the reliability of the results. **P2**
	D 7 Platform Content	- First of all, this is, of course, not the appropriate materials. That is, when the student sees that the material does not fit our program, he loses motivation, he loses interest. **P2** I was interviewed by an autonomous educational organization. There is no such thing as a big disadvantage. Everything is convenient, everything is convenient for the teacher and the student. One thing that is missing is if we do more practical work, after becoming a chemistry teacher, we do practical work - it is interesting for students. If some students do not come when doing the practical work during the lesson, it would be good if it was possible to make videos of the practical work so that the student can watch and understand it himself, and upload the tasks under those videos. I think it will be developed further.**P7**

	D 8 Less able sts	But the downside was that some students could not keep up with strong students and their performance dropped.**P4**
	D9 Assessment	The task is the same for all students in Canvas. The possibilities that ALEKS had are not yet on the Canvas. Maybe in the future. **P7**