

Kazakhstan, 120000, Kyzylorda, 29A Aiteke Bi Str., tel.: +7-705-263-01-83, e-mail: aina_saken75@email.ru, <https://orcid.org/0000-0001-9328-5305>.

Zhailauova Manat Kenessovna – Candidate of Pedagogical Sciences, Associate Professor, "Pedagogy, Psychology and Methods of Primary Education" educational program, Korkyt Ata Kyzylorda University, Republic of Kazakhstan, 120000, Kyzylorda, 29A Aiteke Bi Str., tel.: +7-775-516-93-13, e-mail: mzhailauova@mail.ru, <https://orcid.org/0000-0002-7909-8201>.

IRSTI 14.01.21

UDC 373.1

<https://doi.org/10.52269/SEPT2632106>

FEATURES OF THE PEDAGOGICAL IMPLEMENTATION OF THE COURSE "NETWORK TECHNOLOGIES" AND ITS EFFECT ON STUDENTS OF NAZARBAYEV INTELLECTUAL SCHOOL OF ASTANA

Zulpykhar Zh. Ye. – Candidate of Pedagogical Sciences, Associate Professor, Head of the Department of computer science, L.N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan.

Serikbayeva A.R.* – PhD student, Department of computer science, L.N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan.

Sirozhiddinova I.M. – PhD, Associate Professor, Andijan Engineering Institute, Andijan, Republic of Uzbekistan.

The development of the digital educational environment and the widespread introduction of network and communication technologies into the secondary education system raise the issue of the adoption of specialized IT courses by students. Despite the high level of technical fit-out and the innovative status of Nazarbayev Intellectual Schools, the willingness of students to accept and actively master the course "Network Technologies", as well as the factors influencing this process, require additional scientific analysis. This study is aimed at identifying the factors determining the intention of students of Nazarbayev Intellectual School of Astana to accept and use the knowledge and practical tools of the course "Network Technologies". The study was performed within the framework of a modified Technology Acceptance Model (TAM) supplemented by social and motivational variables. The study employs a quantitative approach. The respondents were selected using a targeted sampling method. An online survey was conducted among students of Nazarbayev Intellectual School of Astana who were currently studying or had previously completed the "Network Technologies" course. The data was processed using the SPSS package and the structural equation modeling (SEM) method. The study results showed that social influence, perceived usefulness of the course and perceived enjoyment have a statistically significant impact on the intention of students to take and master the course "Network Technologies". It has been established that social influence indirectly influences intention through perceived usefulness. At the same time, the perceived ease of learning the course did not demonstrate a significant direct impact on the intention of its adoption. The results obtained emphasize the significant role of pedagogical support and the educational environment in the process of adopting the course "Network Technologies" by students, and also indicate the need to improve teaching methods and practice-oriented course content.

Keywords: network technologies, technology acceptance model (TAM), social influence, perceived usefulness, perceived enjoyment of learning, secondary education, pedagogical support, structural equation modeling (SEM).

«ЖЕЛІЛІК ТЕХНОЛОГИЯЛАР» КУРСЫН ПЕДАГОГИКАЛЫҚ ЕНГІЗУДІҢ ЕРЕКШЕЛІКТЕРІ ЖӘНЕ ОНЫҢ АСТАНА ҚАЛАСЫ НАЗАРБАЕВ ЗИЯТКЕРЛІК МЕКТЕБІНІҢ ОҚУШЫЛАРЫНА ӘСЕРІ

Зулпыхар Ж.Е. – педагогика ғылымдарының кандидаты, қауымдастырылған профессор, Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Астана қ., Қазақстан Республикасы.

Серікбаева А.Р.* – PhD докторанты, Л.Н.Гумилев атындағы Еуразия ұлттық университеті, Астана қ., Қазақстан Республикасы.

Сирождидинова И.М. – PhD, қауымдастырылған профессор, Андижан машина жасау институты, Андижан қ., Өзбекстан Республикасы.

Цифрлық білім беру ортасын дамыту және орта білім беру жүйесіне желілік және коммуникациялық технологияларды кеңінен енгізу білім алушылардың мамандандырылған ІТ курстарын қабылдау проблемасын өзектендіреді. Техникалық жарақтандырудың жоғары деңгейіне және Назарбаев Зияткерлік мектептерінің инновациялық мәртебесіне қарамастан, оқушылардың "Желілік технологиялар" курсын қабылдауға және белсенді игеруге дайындығы, сондай-ақ осы процеске әсер ететін факторлар қосымша ғылыми талдауды талап етеді. Осы зерттеу Астана қаласының

Назарбаев Зияткерлік мектебі оқушыларының "Желілік технологиялар" курсының білімі мен практикалық құралдарын қабылдау және пайдалану ниетін айқындайтын факторларды анықтауға бағытталған. Зерттеу әлеуметтік және мотивациялық айнымалылармен толықтырылған технологияларды қабылдаудың өзгертілген моделі (Technology Acceptance Model, TAM) шеңберінде орындалды. Зерттеу барысында сандық тәсіл қолданылды. Респонденттерді іріктеу мақсатты іріктеу әдісімен жүзеге асырылды. Онлайн-сауалнама Астана қаласының Назарбаев Зияткерлік мектебінің "Желілік технологиялар" курсын оқып жатқан немесе бұрын оқыған оқушылары арасында жүргізілді. Деректерді өңдеу SPSS пакетін және құрылымдық модельдеу әдісін (SEM) қолдану арқылы жүзеге асырылды. Зерттеу нәтижелері әлеуметтік әсер, курстың қабылданған пайдалылығы және оқудан алынатын жағымды әсер оқушылардың "Желілік технологиялар" курсын қабылдау және меңгеру ниетіне статистикалық маңызды әсер ететінін көрсетті. Әлеуметтік әсер қабылданған пайдалылық ниетке жанама әсер ететіні анықталды. Сонымен қатар, курсты игерудің қарапайымдылығы оны қабылдау ниетіне тікелей әсер етпеді. Алынған нәтижелер оқушылардың "Желілік технологиялар" курсын қабылдау процесінде педагогикалық қолдау мен білім беру ортасының маңызды рөлін көрсетеді, сондай-ақ оқыту әдістемесін және курстың тәжірибеге бағытталған мазмұнын жетілдіру қажеттілігін көрсетеді.

Түйінді сөздер: желілік технологиялар, технологияларды қабылдау моделі (TAM), әлеуметтік әсер, қабылданған пайдалылық, оқудан алынатын жағымды әсер, орта білім беру, педагогикалық қолдау, құрылымдық модельдеу (SEM)

ОСОБЕННОСТИ ПЕДАГОГИЧЕСКОГО ВНЕДРЕНИЯ КУРСА «СЕТЕВЫЕ ТЕХНОЛОГИИ» И ЕГО ВЛИЯНИЕ НА УЧАЩИХСЯ НАЗАРБАЕВ ИНТЕЛЛЕКТУАЛЬНОЙ ШКОЛЫ ГОРОДА АСТАНЫ

Зулпыхар Ж.Е. – кандидат педагогических наук, ассоциированный профессор, заведующий кафедрой информатики, Евразийский национальный университет им. Л.Н. Гумилева, г. Астана, Республика Казахстан.

Серікбаева А.Р.* – PhD докторант, Евразийский национальный университет им. Л.Н. Гумилева, г. Астана, Республика Казахстан.

Сирождидинова И.М. – PhD, ассоциированный профессор, Андижанский машиностроительный институт, г. Андижан, Республика Узбекистан.

Развитие цифровой образовательной среды и широкое внедрение сетевых и коммуникационных технологий в систему среднего образования актуализируют проблему принятия специализированных ИТ-курсов обучающимися. Несмотря на высокий уровень технического оснащения и инновационный статус Назарбаев Интеллектуальных школ, готовность учащихся к принятию и активному освоению курса «Сетевые технологии», а также факторы, влияющие на данный процесс, требуют дополнительного научного анализа. Настоящее исследование направлено на выявление факторов, определяющих намерение учащихся Назарбаев Интеллектуальной школы города Астаны принимать и использовать знания и практические инструменты курса «Сетевые технологии». Исследование выполнено в рамках модифицированной модели принятия технологий (Technology Acceptance Model, TAM), дополненной социальными и мотивационными переменными. В ходе исследования был применён количественный подход. Отбор респондентов осуществлялся методом целенаправленной выборки. Онлайн-анкетирование проведено среди учащихся Назарбаев Интеллектуальной школы города Астаны, изучающих или изучавших курс «Сетевые технологии». Обработка данных осуществлялась с использованием пакета SPSS и метода структурного моделирования (SEM). Результаты исследования показали, что социальное влияние, воспринимаемая полезность курса и воспринимаемое удовольствие от обучения оказывают статистически значимое влияние на намерение учащихся принимать и осваивать курс «Сетевые технологии». Установлено, что социальное влияние опосредованно воздействует на намерение через воспринимаемую полезность. При этом воспринимаемая простота освоения курса не продемонстрировала значимого прямого влияния на намерение его принятия. Полученные результаты подчёркивают значимую роль педагогического сопровождения и образовательной среды в процессе изучения учащимися курса «Сетевые технологии», а также указывают на необходимость совершенствования методики преподавания и практико-ориентированного содержания курса.

Ключевые слова: сетевые технологии, модель принятия технологий (TAM), социальное влияние, воспринимаемая полезность, воспринимаемое удовольствие от обучения, среднее образование, педагогическое сопровождение, структурное моделирование (SEM).

Introduction. The rapid development of digital technologies and network infrastructure in recent years has significantly transformed the secondary education system. According to international analytical reports, the use of digital and network technologies is becoming an integral part of the educational process, especially in schools with an in-depth academic and technological focus. In this context, the role of courses

aimed at developing students' modern ICT competencies, including understanding the principles of computer networks and network services, is increasing.

In Kazakhstan, one of the examples of an innovative educational environment is Nazarbayev Intellectual Schools (NIS), where special attention is paid to the introduction of modern technologies and updating the content of academic disciplines. The course "Network Technologies" is considered as an important component of preparing students for further education and professional activity in the digital economy. However, despite the availability of a modern material and technical base and updated educational programs, the degree of acceptance of this course by students, as well as the factors influencing their willingness to actively master the content and practical aspects of the discipline, remain insufficiently studied.

Compared to traditional academic subjects, the course "Network Technologies" is characterized by a high degree of abstraction, reliance on technical concepts and the need to apply practice-oriented teaching methods. This requires students not only to have a certain level of digital training, but also to have a positive attitude towards using online tools, laboratory work, and digital educational resources. Therefore, the acceptance of a course by students depends not only on its content, but also on perceived usefulness, accessibility, interest, and pedagogical support.

Despite the active introduction of digital technologies into the educational process of Nazarbayev Intellectual School (NIS), practice shows that not all students equally demonstrate their readiness to master the course "Network Technologies". A significant role in this process is played by the pedagogical factor, including teaching methods, the level of methodological support and the influence of the teacher as a significant social subject of the educational environment. Insufficient focus on the practical application of knowledge or limited use of interactive and project-based forms of work can reduce students' motivation and their intention to actively participate in the course.

An analysis of scientific research shows that in the context of secondary education in Kazakhstan, there is an extremely limited number of papers devoted to the study of the adoption of ICT-oriented training courses from the perspective of technology adoption models. In particular, factors such as social influence, perceived usefulness of the course, and perceived enjoyment are not sufficiently integrated into the analytical models used to assess students' attitudes toward technology-oriented courses. This is especially true for Nazarbayev Intellectual Schools, where the educational environment is characterized by a high intensity of innovation and expectations from students.

In this regard, this study is aimed at studying the features of the adoption of the course "Network Technologies" by students of the Nazarbayev Intellectual School of Astana on the basis of a modified technology adoption model. Special attention is paid to the analysis of the role of social influence, primarily from teachers, as well as the interaction of this factor with the key components of the acceptance model that determine the intention of students to master the course. The results of the study will expand the understanding of the socio-pedagogical mechanisms of adopting ICT courses in the secondary education system and will contribute to improving the teaching methods of the course "Network Technologies".

The research aims to answer the following research questions:

- What factors influence the intention of students of Nazarbayev Intellectual School of Astana to take and master the course "Network Technologies"?
- How does social influence, including the influence of the teacher, affect the acceptance of the course "Network Technologies" by students?

Literature review. Considering that the course "Network Technologies" is considered as an innovative component of school ICT education, this study uses the Technology Acceptance Model (TAM) as a theoretical basis. The TAM model proposed by Taherdoost [1] is based on the theory of rational behavior and aims to explain the factors determining the adoption and use of information technology. Within the framework of this model, it is assumed that cognitive beliefs, attitudes, behavioral intentions and external factors make it possible to predict users' attitudes towards new technologies and educational innovations [2].

The classical TAM model includes two key determinants of technology adoption: perceived usefulness (UF), which reflects the user's degree of belief that using technology contributes to business efficiency, and perceived ease of use (EOU), defined as the degree to which technology is perceived as understandable and not it requires significant efforts to master [3]. According to Li [4], it is these two factors that have a decisive influence on the formation of behavioral intentions and the adoption of technology. Numerous studies confirm the validity and universality of TAM, including in the field of education and training using digital technologies [5], [6].

With the development of the digital educational environment, the TAM model has been expanded to include additional factors that allow for more comprehensive consideration of the motivational and social aspects of technology adoption. One of these factors is perceived enjoyment (PEEN), which is defined as the degree to which the use of technology is perceived as an interesting and exciting process, regardless of its direct learning or functional results. A number of studies confirm that PEEN has a significant positive impact on the adoption of educational technologies and the formation of intentions for their use [7]–[9].

Another important extension of the TAM model is the social influence factor (SI), originally formulated in the theory of informed action as a "subjective norm". In subsequent studies, this factor was integrated into TAM and proved its importance in the context of educational innovation [10], [11]. Social influence reflects

the impact of significant subjects of the educational environment — primarily teachers and classmates — on the formation of students' attitudes to the curriculum and their willingness to adopt new educational practices.

Taking into account the specifics of the course "Network Technologies", which requires the active use of digital tools, practical tasks and laboratory work, this study uses a modified TAM model supplemented by factors of perceived enjoyment (PEEN) and social influence (SI). This allows a comprehensive analysis of the factors influencing the acceptance of the course by students of the Nazarbayev Intellectual School of Astana.

The study proposes a model that includes five constructs: social influence (SI), perceived usefulness of the course (UF), perceived ease of learning (EOU), perceived enjoyment from studying the course (PEEN), and the intention of students to accept and master the course "Network Technologies" (INT). The proposed research model reflects the interrelationships between these constructs and is used to identify the factors determining course acceptance in an innovative school environment.

Based on the proposed model, the following research hypotheses were formulated:

- H1: The perceived usefulness of the course "Network Technologies" has a positive effect on the intention of students of the Nazarbayev Intellectual School (NIS) of Astana to take and master this course.
- H2: The perceived ease of learning the course "Network Technologies" has a positive effect on the intention of students to take this course.
- H3: The perceived enjoyment of studying the course "Network Technologies" positively influences the intention of students to take this course.
- H4: Social influence positively influences the perceived usefulness of the course "Network Technologies".
- H5: Social influence has a positive effect on the intention of Astana students to take the course "Network Technologies".
- H6: Social influence has an indirect effect on the intention of taking a course in Network Technologies through perceived usefulness.

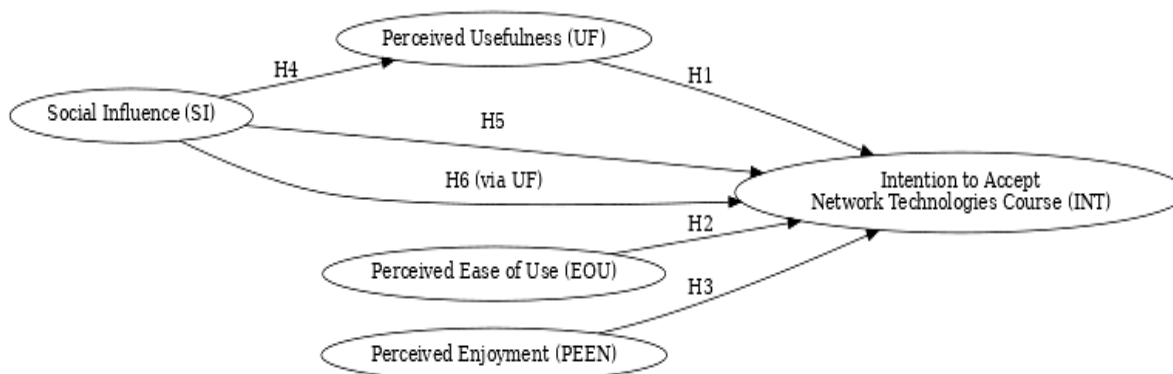


Figure 1 – The research model of the adoption of the course "Network Technologies" by students of Nazarbayev Intellectual School (NIS)

The aim of the study is to identify the key pedagogical and socio-motivational factors influencing students' intention to accept and master the course "Network Technologies" at Nazarbayev Intellectual School of Astana, based on a modified Technology Acceptance Model (TAM).

The objectives of the study are to analyze the pedagogical features of implementing the "Network Technologies" course; to determine the main factors affecting students' course acceptance; to propose and empirically test a structural model explaining students' intention to adopt the course; and to develop practical recommendations for improving teaching methods based on the research findings.

Materials and methods. The present study employed a cross-sectional quantitative design to examine the associations among the constructs included in the proposed research model (see Figure 1). This approach enabled the statistical assessment of relationships between social influence, perceived usefulness, perceived ease of learning, perceived enjoyment, and students' behavioral intention. Because the participants were recruited through purposive sampling from one school, the findings are interpreted as context-specific associations and not as representative estimates for all secondary school students in Kazakhstan.

A questionnaire survey was used to collect empirical data as part of a quantitative study. The questionnaire was developed on the basis of previous research on the application of the technology acceptance model (TAM) in the educational context, with subsequent adaptation of measurement statements to the conditions of schooling and the specifics of the course "Network Technologies".

The questionnaire included measurement elements for five constructs: social influence (SI), perceived usefulness of the course (UF), perceived ease of learning the course (EOU), perceived enjoyment of learning the course (PEEN), and the intention of students to take and master the course "Network Technologies" (INT). Each construct was represented by five statements.

To ensure the meaningful validity of the toolkit, the questionnaire was finalized based on the expert assessments of two specialists in the field of educational technologies and school ICT education.

The questionnaire consisted of two sections. The first section was aimed at collecting demographic information about students, including gender, class of study, educational direction, level of digital training and previous experience in studying ICT disciplines. The second section focused on identifying the factors influencing the adoption and development of the course "Network Technologies".

The questionnaire was developed through a systematic process of construct identification, contextual adaptation, expert evaluation, and final revision. First, the five constructs included in the modified Technology Acceptance Model were defined on the basis of previous TAM-related studies: social influence (SI), perceived usefulness (UF), perceived ease of learning (EOU), perceived enjoyment (PEEN), and behavioral intention to continue engaging with and applying the knowledge and tools acquired in the "Network Technologies" course (INT) [1–11].

An initial pool of statements was developed by adapting items used in previous technology-acceptance studies to the context of secondary education. The original references to the acceptance of a technological system or digital platform were replaced with references to the content, learning activities, practical tools, and educational outcomes of the "Network Technologies" course. Particular attention was given to ensuring that the wording was understandable to students in Grades 9–11 and reflected the educational context of Nazarbayev Intellectual School.

The preliminary questionnaire contained 25 statements, with five items representing each construct. Two experts specializing in educational technology and school ICT education reviewed the statements. The experts evaluated the relevance of each item to its intended construct, clarity of wording, appropriateness for the students' age group, and correspondence with the objectives of the study. Based on their feedback, ambiguous expressions were clarified, overlapping statements were revised, and terminology was standardized. No items were removed; therefore, the final questionnaire retained 25 statements.

All items were measured using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Higher scores indicated a stronger manifestation of the corresponding construct. The questionnaire did not contain reverse-coded items. The complete wording of the measurement items is provided in Appendix A to improve the transparency and reproducibility of the study.

Purposive sampling was used to recruit students from Nazarbayev Intellectual School of Astana who were currently studying or had previously completed the "Network Technologies" course. A total of 156 questionnaires were received. Six questionnaires were excluded because of insufficient response variability and indications of inattentive completion. Consequently, the final analytical sample comprised 150 students. All descriptive statistics, reliability and validity assessments, and structural equation modeling results reported in this study were calculated using these 150 valid responses. With 25 measurement items, the sample provided a ratio of six respondents per item. Although this ratio was considered acceptable for the preliminary SEM analysis, the relatively small, purposively selected sample from one school should be considered when interpreting and generalizing the findings.

Within the framework of descriptive statistics, the main characteristics of the sample were analyzed, including the distribution by gender, class of study, educational field and level of digital training of students. The descriptive statistics were used to characterize the final analytical sample. Because purposive sampling was employed in one school, the sample should not be considered statistically representative of all Nazarbayev Intellectual School students or the broader population of secondary school students in Kazakhstan.

Table 1 – Reliability of measuring scales

The construct	Indicators	Cronbach's alpha when deleting an item	Cronbach's alpha
SI – Social influence	SI1	0,881	0,907
	SI2	0,889	
	SI3	0,874	
	SI4	0,892	
	SI5	0,898	
UF – Perceived usefulness	UF1	0,931	0,948
	UF2	0,934	
	UF3	0,938	
	UF4	0,941	
	UF5	0,936	
EOU – Perceived ease of learning	EOU1	0,915	0,935
	EOU2	0,919	
	EOU3	0,913	
	EOU4	0,928	
	EOU5	0,917	

Continuation of Table 1

PEEN – Perceived enjoyment	PEEN1	0,929	0,940
	PEEN2	0,924	
	PEEN3	0,928	
	PEEN4	0,922	
	PEEN5	0,923	
INT – Course acceptance intention	INT1	0,924	0,939
	INT2	0,923	
	INT3	0,922	
	INT4	0,929	
	INT5	0,925	

Note. All values of the Cronbach's alpha coefficient exceed 0.90, which indicates a high internal consistency of the scales.

Table 2 – Indicators of the validity of measuring scales

Indicator	Meaning
The criterion of adequacy of the Kaiser–Meyer–Olkin sample (KMO)	0,971
Bartlett Sphericity Test	
Approximate value χ^2	12 846,372
Degrees of freedom (df)	300
The level of significance (Sig.)	< 0,001

Note. The obtained values of the KMO and the Bartlett test confirm the factorial suitability of the data and the possibility of using structural equation modeling.

Table 3 – Characteristics of the sample of students of Nazarbayev Intellectual School in Astana

Variable	Category	Frequency	Percent (%)
Gender	Male	68	45.3
	Female	82	54.7
	Total	150	100.0
Grade level	Grade 9	46	30.7
	Grade 10	52	34.7
	Grade 11	52	34.7
	Total	150	100.0
Academic track	Physics and Mathematics	84	56.0
	Natural Sciences	37	24.7
	Humanities	29	19.3
	Total	150	100.0
Previous experience with ICT-related subjects	Yes	128	85.3
	No	22	14.7
	Total	150	100.0
Self-assessed level of digital competence	High	63	42.0
	Medium	66	44.0
	Low	21	14.0
	Total	150	100.0

The results of the reliability and validity analysis confirm the correctness of the measurement scales and their suitability for further analysis using the structural equation modeling (SEM) method in the context of secondary education.

The data was analyzed using the SPSS software packages and the Structural Equation Modeling (SEM) method. The analysis procedure included several stages. At the first stage, descriptive statistics (averages, standard deviations, and coefficients of variation) were calculated for all variables studied.

At the second stage, the convergent and discriminant validity of the constructs was checked within the measurement model.

At the third stage, the structural model assessed the influence of independent variables (SI, UF, EOU, PEEN) on the dependent variable – the intention of students to take and master the course "Network Technologies" (INT).

At the fourth stage, the indirect effect of social influence (SI) on the intention to adopt a course through perceived usefulness (UF) was analyzed.

At the final stage, the hypotheses concerning the associations among the studied constructs were tested.

Results and Discussion. The analysis included 150 valid questionnaires from students of Nazarbayev Intellectual School in Astana. The average values for all measuring points ranged from 4.67 to 5.14, which indicates a generally positive attitude of students towards the course "Network Technologies". The values of the standard deviation were in the range of 1.17–1.28, which indicates an acceptable level of variability in responses and sufficient uniformity of the sample.

The skewness values ranged from -0.707 to -0.243, and the kurtosis ranged from -2.07 to 0.55, which meets the requirements of an approximate normal data distribution and allows the use of structural equation modeling methods. Detailed results of descriptive statistics are presented in Table 4.

Table 4 – Descriptive statistics of measuring points of the course "Network Technologies" (N = 150)

Variable	Max	Min	Average	SD	Asymmetry	Excess
SI1	7	1	4,77	1,24	-0,301	0,097
SI2	7	1	4,69	1,25	-0,293	0,101
SI3	7	1	5,07	1,24	-0,579	0,362
SI4	7	1	5,14	1,21	-0,707	0,532
SI5	7	1	4,78	1,28	-0,239	-0,207
UF1	7	1	4,75	1,24	-0,291	0,010
UF2	7	1	4,78	1,22	-0,270	-0,093
UF3	7	1	4,84	1,26	-0,314	-0,172
UF4	7	1	4,79	1,21	-0,255	-0,041
UF5	7	1	4,99	1,24	-0,511	0,333
EOU1	7	1	4,95	1,21	-0,321	-0,154
EOU2	7	1	4,91	1,19	-0,269	-0,121
EOU3	7	1	4,95	1,17	-0,393	0,109
EOU4	7	1	4,94	1,23	-0,328	0,038
EOU5	7	1	5,00	1,20	-0,380	0,054
PEEN1	7	1	4,86	1,18	-0,243	-0,108
PEEN2	7	1	4,67	1,22	-0,441	0,212
PEEN3	7	1	5,00	1,22	-0,455	0,219
PEEN4	7	1	4,85	1,22	-0,327	0,124
PEEN5	7	1	4,90	1,19	-0,313	0,309
INT1	7	1	4,81	1,22	-0,263	0,021
INT2	7	1	4,91	1,18	-0,369	0,268
INT3	7	1	4,93	1,19	-0,474	0,306
INT4	7	1	4,78	1,21	-0,289	0,067
INT5	7	1	5,04	1,26	-0,571	0,549

Note. The highest average values were recorded for items related to interest in the course and perceived usefulness, reflecting the positive perception of the course "Network Technologies" by students of the Nazarbayev Intellectual School.

The measurement model was evaluated using the AMOS 26.0 software package using the maximum likelihood method. During the analysis, factor loadings, composite reliability (CR), and average extracted variance (AVE) were calculated. The results of the analysis are presented in Table 5.

Table 5 – Convergent validity of the measurement model

The construct	Indicator	Factor load	CR	AVE
SI	SI1	0,837	0,916	0,687
	SI2	0,799		
	SI3	0,882		
	SI4	0,834		
	SI5	0,788		
UF	UF1	0,902	0,952	0,798
	UF2	0,926		
	UF3	0,884		
	UF4	0,861		
	UF5	0,893		
EOU	EOU1	0,899	0,941	0,761
	EOU2	0,889		
	EOU3	0,906		

Continuation of Table 5

	EOU4	0,816		
	EOU5	0,848		
PEEN	PEEN1	0,856	0,945	0,774
	PEEN2	0,885		
	PEEN3	0,862		
	PEEN4	0,899		
	PEEN5	0,895		
INT	INT1	0,894	0,945	0,774
	INT2	0,873		
	INT3	0,894		
	INT4	0,859		
	INT5	0,877		

The standardized factor loads of all measuring points ranged from 0.788 to 0.926, which exceeds the recommended threshold of 0.6 and indicates a high reliability of the indicators. The composite reliability (CR) values for all the studied constructs exceeded 0.8, which confirms the high internal consistency of the scales.

The AVE values for all constructs exceeded 0.5, which indicates sufficient convergent validity of the measurement model.

To assess discriminant validity, the method of comparing AVE square roots with Pearson correlation coefficients between constructs was used. As shown in Table 6, the square roots of AVE exceed the corresponding correlation coefficients, which indicates good discriminant validity of the model.

Table 6 – Indicators of the quality of the structural model fit

The indicator	Recommended value	The value of the model
χ^2	The less, the better	1020,818
df	The more, the better	267
χ^2/df	< 5	3,823
RMSEA	< 0,08	0,074
SRMR	< 0,08	0,080
TLI (NNFI)	> 0,90	0,937
CFI	> 0,90	0,944
GFI	> 0,90	0,926
AGFI	> 0,90	0,917

The results presented in Table 6 show that the model demonstrates satisfactory compliance with empirical data.

The value of the ratio $\chi^2/df = 3.823$, the RMSEA index = 0.074, SRMR = 0.080, and the values of the indices TLI = 0.937, CFI = 0.944, GFI = 0.926 and AGFI = 0.917 exceed the threshold value of 0.9. The results obtained indicate the acceptable quality of the structural model for the adoption of the course "Network Technologies" by students of the Nazarbayev Intellectual School.

Table 7 – The path coefficients of the structural model

Hypothesis	Way	β	t / S.E.	p	Result
H1	UF → INT	0,306	5,538	<0,001	Confirmed
H2	EOU → INT	0,102	1,945	0,052	Not confirmed
H3	PEEN → INT	0,387	7,790	<0,001	Confirmed
H4	SI → UF	0,758	17,666	<0,001	Confirmed
H5	SI → INT	0,171	3,251	0,001	Confirmed

The results of the analysis of the path coefficients presented in Table 7 showed that:

- Social influence (SI) has a statistically significant impact on the perceived usefulness of the course (UF) ($\beta = 0,758$, $p < 0,001$);
- Perceived usefulness (UF) ($\beta = 0.306$, $p < 0.001$) and perceived enjoyment (PEEN) ($\beta = 0.387$, $p < 0.001$) they have a significant impact on the intention of students to take the course "Network Technologies" (INT);
- The perceived ease of learning (EOU) did not demonstrate a statistically significant effect on INT ($\beta = 0.102$, $p = 0.052$).

The coefficient of determination R^2 showed that 57.5% of the UF variance was due to social influence, and 69.9% of the INT variance was due to the combined effects of SI, UF, EOU and PEEN (see Figure 2).

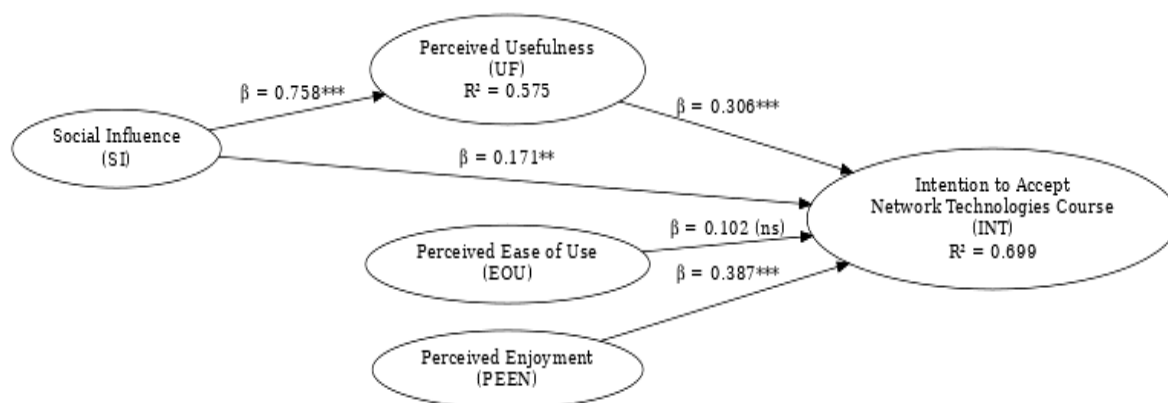


Figure 2 – Structural model of students' acceptance of the course "Network Technologies"

The analysis of the results confirmed the following hypotheses:

- H1 – confirmed: the perceived usefulness of the course positively influences the intention to adopt it;
- H2 – not confirmed: the perceived ease of learning the course does not have a statistically significant effect on the intention of the students;
- H3 – confirmed: the perceived enjoyment of learning a course significantly influences its acceptance;
- H4 – confirmed: social influence has a positive effect on the perceived usefulness of the course;
- H5 – confirmed: social influence has a direct impact on the intention to adopt a course.

An analysis of the mediation effect using the bootstrap method (1,000 repetitions) showed that the perceived usefulness of the course (UF) acts as a complete mediator between social influence (SI) and the intention of students to take the course "Network Technologies" (INT).

The indirect effect was statistically significant ($p = 0.045$), while the confidence interval [0.028; 0.502] did not include a zero value. At the same time, the direct effect of $SI \rightarrow INT$ turned out to be statistically insignificant ($p = 0.288$), which confirms the presence of complete mediation. Thus, the H6 hypothesis was confirmed.

Table 8 – Mediation effect Analysis (Bootstrap, 1,000 repetitions)

Effect	Evaluation	SE	Z	p	95% DI (bottom)	95% DI (upper)
The overall effect $SI \rightarrow INT$	0,418	0,147	2,852	0,004	0,149	0,719
Indirect effect (via UF)	0,241	0,120	2,009	0,045	0,028	0,502
Direct effect $SI \rightarrow INT$	0,177	0,167	1,063	0,288	-0,111	0,557

The results of this study, carried out on the basis of the structural equation modeling method, allowed us to identify the key factors influencing the adoption of the course "Network Technologies" by students of the Nazarbayev Intellectual School of Astana. The data obtained confirmed the applicability of the modified TAM model in secondary education and demonstrated its high explanatory ability.

It has been established that the perceived usefulness of a course is one of the key predictors of the intention to adopt it. Students who consider the course "Network Technologies" as significant for the development of digital and engineering competencies show a higher willingness to master it.

The lack of a statistically significant impact of the perceived ease of learning of the course may be due to the specifics of the educational environment of Nazarbayev Intellectual School (NIS), where students have a fairly high level of digital literacy and do not perceive the complexity of the content as a critical barrier.

At the same time, the perceived enjoyment of learning the course had a significant positive impact on its adoption, which underscores the importance of using interactive, practice-oriented and project-based forms of learning in teaching "Network Technologies".

The factor of social influence, primarily from the teacher, demonstrated particular importance in the framework of the study. Pedagogical recommendations, support and methodological support significantly increase the perceived usefulness of the course, and through it, the intention of students to accept and master the discipline, which confirms the key role of the teacher as a mediator between the content of the course and the educational motivation of students.

Conclusion. In this study, the features of the adoption of the course "Network Technologies" by students of the Nazarbayev Intellectual School of Astana were studied on the basis of a modified technology adoption model (TAM). The results of the analysis confirmed that three key factors – Social influence (SI), perceived usefulness of the course (UF) and perceived enjoyment from studying it (PEEN) – have a statistically significant impact on the intention of students to take and master this course.

An additional analysis of the role of social influence showed that pedagogical support, teacher recommendations and his active use of course elements in the educational process have a significant impact on the formation of a positive attitude of students towards the course "Network Technologies". This confirms the key role of the teacher as a mediator between the content of the academic discipline and the educational motivation of students in an innovative school environment.

The results obtained are of practical importance for the administration and teachers of Nazarbayev Intellectual Schools, as they allow us to identify potential problems and areas for improving the teaching of ICT-oriented disciplines. In particular, the results of the study indicate the need to strengthen the practice-oriented content of the course, expand the range of laboratory and project tasks, as well as the use of interactive forms of learning that enhance student learning interest and engagement.

It is important to note that the perceived ease of learning the course did not demonstrate a statistically significant effect on the intention to take it. This may be due to the relatively high level of digital education of Nazarbayev Intellectual School (NIS) students, for whom the complexity of the content is not a key deterrent. Nevertheless, this aspect requires further study, since the results of the study partially differ from the conclusions of a number of previous works performed in other educational contexts.

Despite the significant findings, the study has several limitations that should be considered when interpreting the results. The participants were recruited through purposive sampling from only one Nazarbayev Intellectual School in Astana. This educational setting may differ substantially from other Kazakhstani secondary schools in terms of student selection, digital infrastructure, availability of technological resources, teacher preparation, and the intensity of ICT-oriented instruction. These contextual characteristics may contribute to students' relatively high level of digital competence and their positive perceptions of the usefulness and enjoyment of the "Network Technologies" course. They may also explain why perceived ease of learning did not significantly predict students' behavioral intention.

Consequently, the reported associations should be interpreted as context-specific findings rather than as estimates that represent all secondary school students in Kazakhstan. The strength and significance of the relationships identified in the structural model may differ in mainstream urban schools, rural schools, and schools with more limited technological infrastructure. The results therefore cannot be directly generalized to the national school population. Future research should employ a larger, multi-site sample including Nazarbayev Intellectual Schools, mainstream public schools, and rural and urban educational institutions from different regions of Kazakhstan. Stratified or probability-based sampling would further improve the external validity of the findings. In addition, interviews or focus groups could provide a deeper understanding of how school context influences students' acceptance of ICT-oriented courses.

In general, the results of the study expand the understanding of the mechanisms of adoption of ICT-oriented training courses in the secondary education system and can be used to improve the teaching methods of the course "Network Technologies" in Nazarbayev Intellectual Schools and other innovative educational institutions.

Conflict of interest: The authors declare no conflict of interest.

REFERENCES:

- 1 Taherdoost H. A review of technology acceptance and adoption models and theories. *Procedia manufacturing*, 2018, vol. 22, pp. 960-967. <https://doi.org/10.1016/j.promfg.2018.03.137>.
- 2 Kemp A., Palmer E., Strelan P. A taxonomy of factors affecting attitudes towards educational technologies for use with technology acceptance models. *British Journal of Educational Technology*, 2019, vol. 50(5), pp. 2394-2413. <https://doi.org/10.1111/bjet.12833>.
- 3 Amin M., Rezaei S., Abolghasemi M. User satisfaction with mobile websites: the impact of perceived usefulness (PU), perceived ease of use (PEOU) and trust. *Nankai Business Review International*, 2014, vol. 5(3), pp. 258-274. <https://doi.org/10.1108/NBRI-01-2014-0005>.
- 4 Li W. A study on factors influencing designers' behavioral intention in using AI-generated content for assisted design: Perceived anxiety, perceived risk, and UTAUT. *International Journal of Human-Computer Interaction*, 2025, vol. 41(2), pp. 1064-1077. <https://doi.org/10.1080/10447318.2024.2310354>.
- 5 Mastour H., Yousefi R., Niroumand S. Exploring the acceptance of e-learning in health professions education in Iran based on the technology acceptance model (TAM). *Scientific Reports*, 2025, vol. 15(1), art. 8178. <https://doi.org/10.1038/s41598-025-90742-5>.
- 6 Alyoussef I.Y. Acceptance of a flipped classroom to improve university students' learning: An empirical study on the TAM model and the unified theory of acceptance and use of technology (UTAUT). *Heliyon*, 2022, vol. 8(12). <https://doi.org/10.1016/j.heliyon.2022.e12529>.
- 7 Teo T. Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, 2011, vol. 57(4), pp. 2432-2440. <https://doi.org/10.1016/j.compedu.2011.06.008>.
- 8 Punnoose A.C. Determinants of intention to use eLearning based on the technology acceptance model. *Journal of Information Technology Education: Research*, 2012, vol. 11(1), pp. 301-337. <https://doi.org/10.28945/1744>.

9 Chen J.L. The effects of education compatibility and technological expectancy on e-learning acceptance. *Computers & Education*, 2011, vol. 57(2), pp. 1501-1511. <https://doi.org/10.1016/j.compedu.2011.02.009>.

10 Al-Rahmi W.M. et al. Integrating technology acceptance model with innovation diffusion theory: An empirical investigation on students' intention to use E-learning systems. *Ieee Access*, 2019, vol.7, pp. 26797-26809. <https://doi.org/10.1109/ACCESS.2019.2899368>.

11 Peng R., Abdul Razak R., Hajar Halili S. Factors influencing in-service teachers' technology integration model: Innovative strategies for educational technology. *PloS one*, 2023, vol. 18(8), art. e0286112. <https://doi.org/10.1371/journal.pone.0286112>.

Received: 03 May 2026. **Accepted:** 07 June 2026. **Published:** 30 September 2026.

APPENDIX A. QUESTIONNAIRE ITEMS USED TO MEASURE THE STUDY CONSTRUCTS

Instructions for participants: Please indicate the extent to which you agree with each statement concerning the “Network Technologies” course. Responses were recorded using a seven-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, and 7 = strongly agree.

Construct	Code	Measurement statement
Social influence	SI1	My teacher encourages me to engage actively with the “Network Technologies” course.
	SI2	My teacher considers the knowledge provided by this course important for my education.
	SI3	My classmates generally have a positive attitude toward the “Network Technologies” course.
	SI4	People whose opinions are important to me believe that studying network technologies is useful.
	SI5	The school environment encourages students to develop knowledge and skills in network technologies.
Perceived usefulness	UF1	The course improves my understanding of how computer networks operate.
	UF2	The course develops digital competencies that are useful for my studies.
	UF3	The knowledge acquired in the course will be useful in my future education.
	UF4	The course helps me solve practical problems related to network technologies.
	UF5	The competencies developed through the course may be useful for my future career.
Perceived ease of learning	EOU1	The main concepts presented in the course are understandable to me.
	EOU2	I find it easy to follow the explanations and instructions provided during the course.
	EOU3	Learning how to use the network tools introduced in the course is easy for me.
	EOU4	I can complete the practical assignments without excessive difficulty.
	EOU5	It is easy for me to become proficient in the skills taught in the course.
Perceived enjoyment	PEEN1	I enjoy studying the topics included in the “Network Technologies” course.
	PEEN2	The learning activities provided in the course are interesting to me.
	PEEN3	I find the practical and laboratory assignments engaging.
	PEEN4	Participating in course projects is an enjoyable learning experience.
	PEEN5	Overall, studying network technologies is enjoyable for me.
Behavioral intention	INT1	I intend to continue developing my knowledge of network technologies.
	INT2	I would choose additional learning activities related to network technologies if they were available.
	INT3	I intend to apply the knowledge and tools acquired in the course in future learning activities.
	INT4	I would recommend the “Network Technologies” course to other students.
	INT5	I would participate in an advanced network technologies course if I had the opportunity.

Information about the authors:

Zulpykhar Zhandos Yensebekuly – Candidate of Pedagogical Sciences, Associate Professor, Head of the Department of computer science, L.N. Gumilyov Eurasian National University, Republic of Kazakhstan, 010005, Astana, 11 Pushkin Str., tel.: +7 707 769 1979, e-mail: astzhan@gmail.com.

Serikbayeva Aiyim Raiymbekkyzy* – PhD student, Department of Computer Science, L.N. Gumilyov Eurasian National University, Republic of Kazakhstan, 010005, Astana, 11 Pushkin Str., tel.: +77029651716, e-mail: sar93.01@mail.ru.

Sirozhiddinova Iroda Makhammadovna – PhD, Associate Professor, Andijan Engineering Institute, Republic of Uzbekistan, 170100, Andijan, 56 Alisher Novoi Str., e-mail: siroziddinovairoda@gmail.com.

Зулпыхар Жандос Енсебекұлы – педагогика ғылымдарының кандидаты, қауымдастырылған профессор, информатика кафедрасының меңгерушісі, Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Қазақстан Республикасы, 010005 Астана қ., Пушкин көш. 11, тел.: +7 707 769 1979, e-mail: astzhan@gmail.com.

Серікбаева Айым Райбекқызы* – PhD докторанты, Информатика кафедрасы, Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Қазақстан Республикасы, 010005 Астана қ., Пушкин көш. 11, тел.: +77029651716, e-mail: sar93.01@mail.ru.

Сирождидинова Ирода Махаммадовна – PhD, қауымдастырылған профессор, Андижан машина жасау институты, Өзбекстан Республикасы, 170100 Андижан қ., Алишер Новои 56, e-mail: siroziddinovairoda@gmail.com.

Зулпыхар Жандос Енсебекұлы* – кандидат педагогических наук, ассоциированный профессор, заведующий кафедрой информатики, Евразийский национальный университет им. Л.Н. Гумилева, Республика Казахстан, 010005 г. Астана, ул. Пушкина 11, тел.: +7 707 769 1979, e-mail: astzhan@gmail.com.

Серікбаева Айым Райбекқызы* – PhD докторант, кафедра информатики, Евразийский национальный университет им. Л.Н. Гумилева, Республика Казахстан, 010005 г. Астана, ул. Пушкина 11, тел.: +77029651716, e-mail: sar93.01@mail.ru.

Сирождидинова Ирода Махаммадовна – PhD, ассоциированный профессор, Андижанский машиностроительный институт, Республика Узбекистан, 170100 г. Андижан, ул. Алишера Новои 56, e-mail: siroziddinovairoda@gmail.com.

XFTAP 14.25.01

ӨОЖ 373.5

<https://doi.org/10.52269/SEPT2632117>

ОҚУШЫНЫҢ СӨЗСАПТАМЫН ДАМУДЫҢ ӘЛЕУМЕТТІК МӘНІ

Кайырбаева Ж.К.* – сениор-лектор, докторант, Сәрсен Аманжолов атындағы Шығыс Қазақстан университеті, Өскемен қ., Қазақстан Республикасы.

Рахметова Р.С. – педагогика ғылымдарының докторы, қауымдастырылған профессор, Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы қ., Қазақстан Республикасы.

Мақалада оқушының сөзсаптамын дамыту үдерісінің әлеуметтік мәні терең қарастырылады. Автор қазіргі ақпараттық қоғамда тіл мәдениетінің төмендеуі мен сөйлеу дағдысының әлсіреуі оқушылардың тұлғалық қалыптасуы мен әлеуметтік белсенділігіне елеулі ықпал ететінін алға тартады. Зерттеу 2024–2025 оқу жылының бірінші жартысында 10-сынып оқушылары арасында жүргізіліп, педагогикалық бақылау, жазбаша және ауызша жұмыстарды талдау, сұхбаттасу әдістері қолданылды. Нәтижесінде оқушылардың сөйлеу деңгейі мен олардың әлеуметтік белсенділігі, өзін-өзі танытуы, көшбасшылық қабілеттері арасында тығыз байланыс бары дәлелденді. Эксперименттік сыныпта қолданылған диалогтік оқыту, пікірталас, жобалық тапсырмалар мен рефлексиялық жұмыстар оқушылардың тілдік қана емес, коммуникативтік және эмоционалдық қабілеттерін де арттырған. Автор сөйлеу мәдениетін дамыту тек грамматикалық машық емес, тұлғаның әлеуметтік интеграциясы мен өзіндік позициясын қалыптастырудағы шешуші фактор екенін дәлелдейді. Мақалада мұғалім рөлінің маңыздылығы, сөйлеу дағдысын дамытудың тиімді педагогикалық әдістері мен цифрлық құралдардың әлеуеті де талданған. Зерттеу қорытындысы бойынша, сөзсаптамды дамыту – оқушының сыни ойлауын, сенімділігін, көпшілік алдында сөйлеу дағдысын жетілдіретін, нәтижесінде оның қоғамдағы белсенді мүшеге айналуына жол ашатын көпқырлы педагогикалық процесс ретінде қарастырылады.

Түйінді сөздер: сөйлеу мәдениеті, сөзсаптам, әлеуметтік даму, коммуникативтік құзыреттілік, тілдік әрекет.