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FORMATION OF STUDENTS' INFORMATION SECURITY COMPETENCE THROUGH PROJECT-BASED LEARNING

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Abstract. Currently, a number of studies indicate that the rapid development of digital technologies and the endless expansion of the information space have a negative impact on the personal, psychological, and physiological development and socialization of young people. Teenagers' susceptibility to misinformation on the internet and the impact of information manipulation highlight the need to ensure their information security. In this regard, the importance of developing information security skills among school students is increasing. These skills include the ability to critically evaluate information, determine the reliability of sources, recognize information threats and counter them, developing digital literacy and ethical behavior in the online environment. This paper examines the potential of the project-based learning as an innovative pedagogical approach in the development of these skills. The main aim of this study is to determine the pedagogical effectiveness of the project-based learning in the process of developing information-security skills at the secondary education level.

In the course of the study, a theoretical analysis of scientific literature related to the field of information security was conducted and it was found that, despite the fact that the project-based learning is widely used in general education practice, its role in the development of information-security skills has not been systematically studied. In this regard, an experimental study was conducted and the results were subjected to statistical analysis.

Based on the results obtained, it is emphasized that information-security skills in the learning process of secondary school students are an important qualitative component of a student's personality. A conclusion was made about the need for effective application of the project-based learning for the purposeful formation of these skills in the education system. The conclusions obtained in the course of the study can serve as a theoretical and methodological basis for the development of curricula and programs for secondary school students.

Keywords: information security, project-based learning, secondary school students, digital literacy, pedagogical effectiveness, emotional-psychological state, innovative teaching methods, critical thinking

Introduction

In modern society, the importance of the internet in the lives of young people is increasing. The widespread use of digital technologies offers students new opportunities for learning, social interactions, personal development, creative self-expression, and access to global information resources. However, active use

of the internet from an early age also leads to a number of risks. Adolescents, in the process of acquiring digital literacy, may encounter harmful content or be exposed to inappropriate behavior in virtual environment. In this regard, ensuring the information security of the younger generation is one of the key tasks of the current education system.

The transition to an information society and the active integration of innovative digital technologies into the educational process have led to changes in learning objectives and content. Today, the education system is focused on developing students' creative activity and fostering independent thinking by teaching to work information autonomously. However, the dynamics and content of the current information space are becoming significant factors that pose a serious threat to student's information security.

In her research, L.B. Urbanova identified the following factors that may threaten adolescents' information security in the information environment:

- The accessibility, lack of control, and unlimited distribution of information to schoolchildren;
- The presence of modified physical media in the information environment that affect the child's psychological systems;
- The presence of specific element in information flows that are aimed at deliberately altering the psychophysiological state of children and adolescents;
- The existence of manipulative information in the information environment that limits their capabilities due to low legal literacy and age-specific characteristics [1].

Specialists from Kaspersky lab conducted a study on the most common online threats faced by children and based on the frequency of the "parental control" function being triggered, arrived at the following conclusions: in 37.03% of cases – various negative that content; in 9.38% – content related to alcohol, smoking, and drugs; in 5.54% – weapons; in 4.53% – profanity; in 3.83% – gambling; in 3% – violence; in 2.66% – services providing anonymous internet access [2].

Today, it is impossible to completely isolate children from threats in this area, as internet access is widespread and virtually unrestricted. In this regard, taking appropriate preventive measures to foster a culture of information security has become particularly relevant. One such preventive measure is teaching children how to behave safely in the information environment and enhancing their information culture.

At present, in the field of education, innovative methods aimed at increasing students' cognitive activity and independence are widely used instead of traditional teaching methods. An innovative method is considered a process of psychological and pedagogical influence that enables the process through the collection, processing, use, and dissemination of information [3]. Such

mechanism of influence requires the active participation of learners, as it is well known that personal development primarily occurs through active engagement. This statement highlights the importance of introducing educational technologies based on independent and collaborative activities that contribute to the acquisition of new knowledge by learners [4].

From these perspectives, one of the key directions of innovative pedagogical methods in general secondary education institutions is the effective organization of student's project-based activities. E.S. Ratsapevich interprets research as both a process and an outcome of scientific inquiry, emphasizing its purposeful nature directed toward obtaining new and socially meaningful knowledge [5]. According to Zh. Qonytbayeva, G. Kaliev, and K. Esenova, the term "project," derived from the Latin projectus ("thrown forward"), denotes a coordinated and goal-oriented activity aimed at producing a distinctive outcome that meets specific pedagogical or practical requirements [6].The interrelation between research and project activity is a special type of educational work aimed at solving cognitive tasks of a creative nature in various fields such as science, technology, and art where the result is not known in advance. This type of activity includes the main stages typical of research: problem formulation, hypothesis development, data collection, analysis, and drawing conclusions [7].

An effective way to develop students' information-security competence is through the integration of research-based inquiry into project-oriented learning. According to E.A. Ganieva, project-based learning represents a pedagogical form of student activity that involves the independent planning, organization, and implementation of research tasks [8]. This process includes identifying the topic, setting learning goals, selecting methods, developing a work plan, predicting expected outcomes, and evaluating the results.

Within this framework, students acquire a system of skills that promote critical and creative engagement with information. These include the ability to formulate research questions that can be answered through systematic investigation; to select and apply appropriate research methods; to analyze data; to articulate and defend their own positions; and to connect scientific knowledge with ethical and value-based principles. The formation of such skills directly contributes to information-security competence, as students learn to evaluate information critically, identify manipulation and misinformation, and make responsible digital decisions.

A.V. Vilkova highlights that fostering a culture of information security requires pedagogical approaches that combine knowledge acquisition with value formation and practical application [9]. The project-based method, by engaging students in authentic inquiry, provides such integration. It allows learners to not only acquire theoretical understanding but also to apply it in contexts related to online ethics, personal data protection.

M.P. Zaremba and M. Kolodziejski emphasize that project-oriented learning, through individual and group work, encourages interdisciplinary problem-solving and promotes practice-oriented learning, which is essential in the field of

information security [10]. Similarly, J.W. Thomas and J.R. Mergendoller argue that each project should lead to a tangible outcome: theoretical projects should produce well-grounded analytical conclusions, while applied projects should result in products relevant to real digital contexts [11].

Building on these perspectives, contemporary researchers view educational projects as an effective pedagogical tool for developing students' competencies in digital safety and critical information literacy [12]. Through engagement in such activities, learners acquire the capacity to recognize online threats, analyze risks, and participate actively in the creation of safe and ethical digital environments.

Despite the widespread use of the project-based approach in general education, its pedagogical potential for shaping students' information-security competence remains insufficiently explored. Therefore, this study *aims* to theoretically substantiate and experimentally verify the effectiveness of project-based learning as a method for developing adolescents' skills in critical evaluation of information, safe online behavior, and responsible digital communication.

To achieve this aim, the following *research objectives* were formulated:

1. To analyze the theoretical foundations of information security education and determine how project-based learning can serve as an effective pedagogical framework for its implementation in modern schooling.
2. To design and apply an instructional program that integrates information-security content with project-based tasks, enabling students to acquire knowledge, analytical skills, and responsible digital behavior.
3. To evaluate the pedagogical impact of this integrated model by comparing changes in students' information-security competence after participation in project-based learning and traditional instruction.

These objectives lead to the central *research question* of the study: How effectively does project-based learning enhance secondary-school students' information-security competence?

Materials and Methods

The study was designed to examine the pedagogical effectiveness of project-based learning as a method for developing information-security competence among secondary school students. To achieve this purpose, a quasi-experimental pretest–posttest design with control and experimental groups was employed. The choice of a quasi-experimental design was determined by the constraints of the natural school environment (the impossibility of random assignment of students to classes). This design allowed for the systematic comparison of students' progress in mastering information-security knowledge and attitudes through project-based learning versus traditional instruction.

A comprehensive methodological approach was applied, integrating both quantitative and qualitative methods to ensure the validity, reliability, and depth of interpretation. Quantitative analysis measured the changes in information-security competence levels, while qualitative observation and feedback provided insights into the students' motivation and engagement in project-based activities.

The intervention was carried out during the 2023–2024 academic year at the Nazarbayev Intellectual School in Astana. The study sample consisted of 127 students aged 14–16, representing grades 9–10. The experimental group (n = 64) participated in the project-based learning program, while the control group (n = 63) studied the same content using conventional methods. Participation was voluntary, and written informed consent was obtained from both students and parents in accordance with institutional ethical guidelines.

The experiment was conducted in three stages:

1. Diagnostic Stage (October 2023): Both groups completed a pretest to determine their baseline level of information-security competence, including knowledge of online safety and risk awareness.

2. Formative Stage (November 2023 – March 2024): The experimental group engaged in a specially designed project-based program entitled *"Click by Click: My Digital Future."* Students explored real-world issues in information security through research-oriented projects, collaborative inquiry, and creative problem solving. Continuous formative assessment and teacher observation were conducted to monitor learning progress.

3. Control Stage (April 2024): A posttest was administered to both groups to evaluate the effect of project-based learning on the development of students' information-security competence, followed by comparative statistical analysis of the results.

The instructional program was centered on information-security education and combined subject knowledge with project-based inquiry. Students selected topics of personal relevance within six thematic areas: (1) ensuring information security and understanding digital risks; (2) internet ethics, cyberbullying, and data protection;

(3) threat analysis and preventive strategies in information systems;

(4) online privacy and responsible social media use;

(5) ethical challenges and risks associated with artificial intelligence; (6) promoting peer awareness of information-security culture.

Each project followed a consistent structure:

- formulation of a research question related to information security;
- setting of objectives and expected learning outcomes;
- development of a project plan integrating research methods and creative tasks;
- presentation and defense of final products (e.g., analytical reports, infographics, simulations, multimedia presentations).

Through this process, students learned to apply theoretical knowledge in authentic digital contexts, developing critical evaluation, responsible decision-making, and collaborative problem-solving skills, all of which represent essential components of information-security competence.

To evaluate the effectiveness of the project-based approach, four criteria reflecting the multidimensional structure of information-security competence were established:

1. Cognitive criterion: understanding of core information-security concepts and ability to verify the reliability of digital sources;

2. Emotional-psychological criterion: capacity to recognize and manage stress or anxiety caused by informational overload and online risks;

3. Social criterion: demonstration of safe, ethical, and responsible digital interaction;

4. Motivational criterion: sustained interest in information-security issues and active participation in project collaboration.

A 20-item diagnostic questionnaire was developed, covering these four components and rated on a 5-point Likert scale, later rescaled to a 10-point metric. The instrument's reliability coefficients (Cronbach's $\alpha = 0.78–0.86$) confirmed satisfactory internal consistency.

Quantitative data were analyzed using IBM SPSS Statistics. Descriptive statistics summarized the participants' initial and final competence levels. An independent-samples t-test was applied to assess differences between the control and experimental groups in pre- and posttest results. Pearson's correlation analysis was used to examine relationships among cognitive, emotional, social, and motivational dimensions of information-security competence.

This methodological framework ensured a balanced combination of pedagogical experimentation and statistical verification, providing valid evidence that project-based learning can serve as an effective tool for developing students' information-security competence in secondary education.

Results and discussion

As a result of the conducted experiment, we obtained the following outcomes. According to the cognitive criterion, students' awareness of information threats was: high level – 9%, medium level – 47%, low level – 44%. For example, 68% of students were unable to correctly answer the question, "What is information security?" Responses to the question "How do you check whether a news story is real or fake?" showed that most students either do not use any skills to verify the authenticity of information or do not consider this aspect at all. These findings are illustrated in Figure 1.

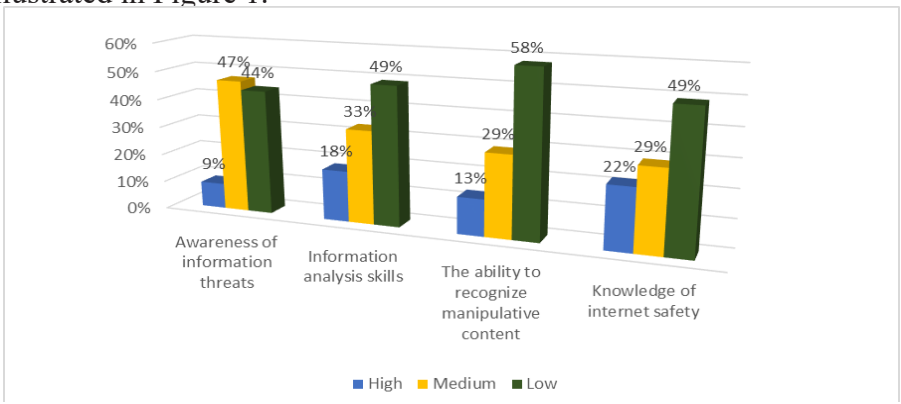

Figure 1 – The results based on the cognitive criterion during the diagnostic stage

According to the results, 57% of participants reported feeling exhausted due to information overload, which caused them anxiety. Only 16% of students stated that they were confident in their ability to actively resist informational attacks, while the rest expressed doubts or were unable to provide a clear answer. Trust in information sources also varied: 13% of surveyed students said they were skeptical of the information found on social media, whereas the rest admitted to consuming such content without verifying its accuracy. The research results are presented in Figure 2.

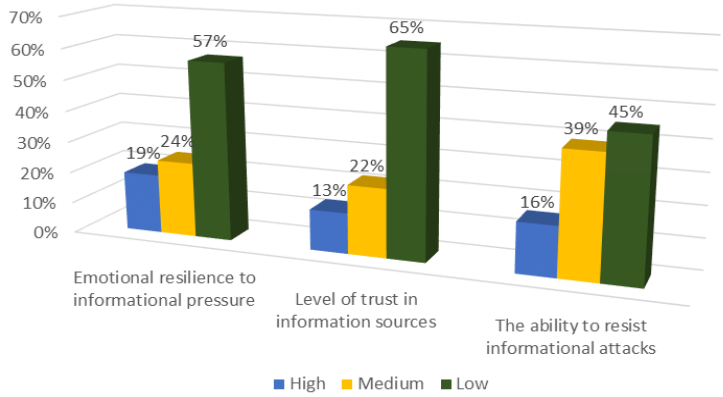

Figure 2 – Results of the assessment of students emotional-psychological state related to information security during the diagnostic stage

During the assessment of student's social skills related to information security ability to act safely in the digital society, and skills related to digital etiquette were examined. 58% of participants noted that they first learned the rules of information security from their parents or teachers. 29% of respondents indicated that they acquired this knowledge independently through internet. Although most students expressed and understanding of the need to interact safely and politely with others in the digital environment, they admitted that they do not always follow these rules in practice. The indicators of students' social skills related to information security are shown in Figure 3.

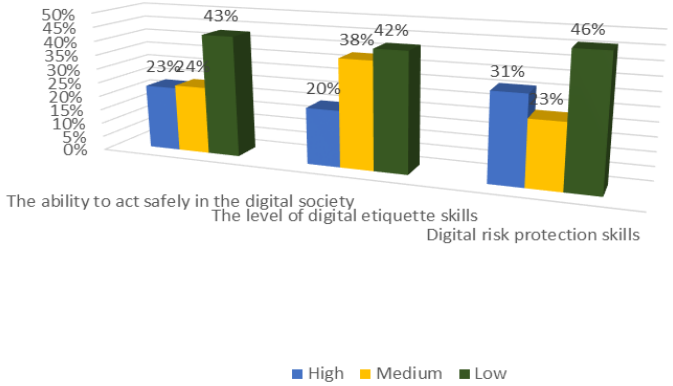

Figure 3 – Results of the assessment of student's social skills related to information security during diagnostic stage

According to the results of the survey, the majority of students consider the issue of information security to be important. 39% of participants rated this topic as very important, while 44% indicated that it is only necessary within the framework of the school curriculum. The remaining 17% stated that they do not give much importance to information security or not interested in it. When assessing the desire to gain knowledge about safe behavior on the internet, only 36% of students showed a willingness to receive additional education in this area. The results are shown in Figure 4.

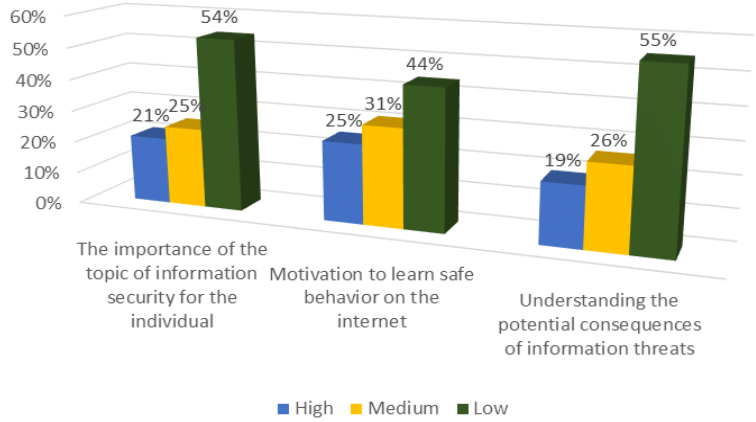

Figure 4 – results of the assessment of student's indicators according to motivational criterion related information security during diagnostic stage

The results of the survey conducted during the control stage of the experiment based on the cognitive criterion showed a positive trend in students' awareness of information threats: the high-level indicator increased from 23% to 44%, while the low-level indicator decreased from 42% to 27%. The data related to the skill of analyzing information also demonstrated positive changes: the low-level indicator decreased from 49% to 33%. The results are illustrated in Figure 5.

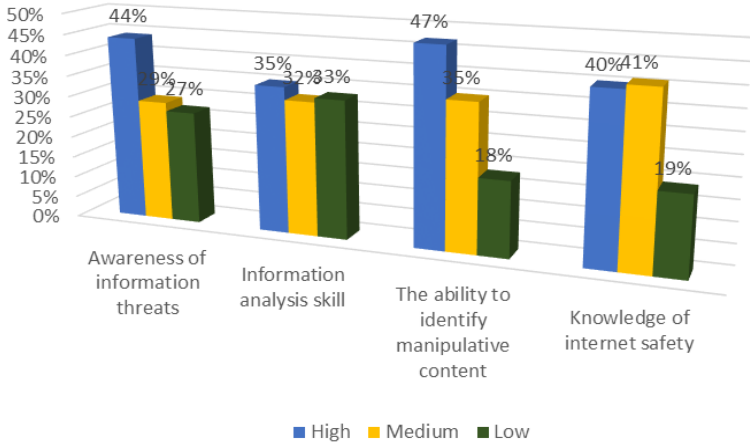

Figure 5 – Survey results based on the cognitive criterion during the control stage of the experiment

The results of the survey conducted during the control stage showed a significant increase in students emotional and psychological resilience under informational pressure. The high-level resilience indicator increased from 19% to 33%, while the medium-level indicator rose from 24% to 43%. At the same time, a noticeable decrease in the low-level share was observed. For example, at the diagnostic (pretest) stage, 67% of respondents answered the question "What is your reaction when encountering false information?" with "I worry, I get stressed" whereas during the control stage, 63% of students responded, "I check the source of the information". In addition, the high-level indicator of trust in information sources increased from 13% to 43%. The research results are presented in Figure 6.

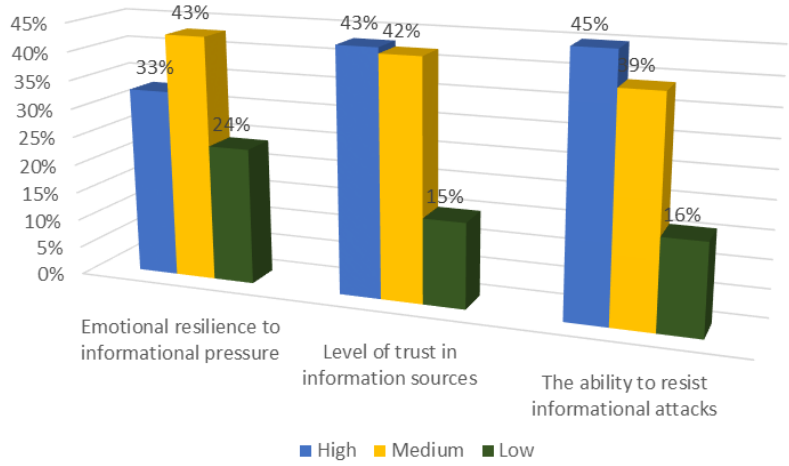

Figure 6 – Results of the assessment of students emotional-psychological state related to information security during the control stage

The high-level indicator of the ability to act safely in the digital society increased from 23% to 44%, while the medium-level indicator rose from 24% to 47%. Positive dynamics were also observed in digital etiquette skills: the high-level indicator increased from 20% to 52%. For example, in response to the question "What do you do before posting personal or someone else's information online?" the majority of respondents in the initial stage answered "I post without thinking", whereas during the control stage, most answered "I carefully assess the content and its consequences". The research results are presented in Figure 7.

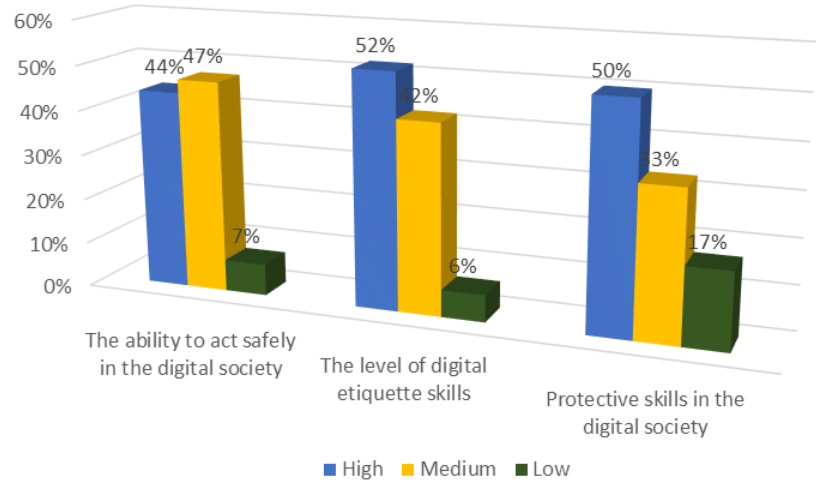

Figure 7 – Results of the assessment of student's social skills related to information security during the control stage

The proportion of respondents who rated the importance of the topic of information security at a high level for the individual increased from 21% to 43%. For example, in response to the question "How important is information security to you?" 27% of respondents the initial stage answered "Not important, I don't pay much attention," while in the control stage 53% answered "Very important, I pay attention to it daily." The research results are presented in Figure 8.

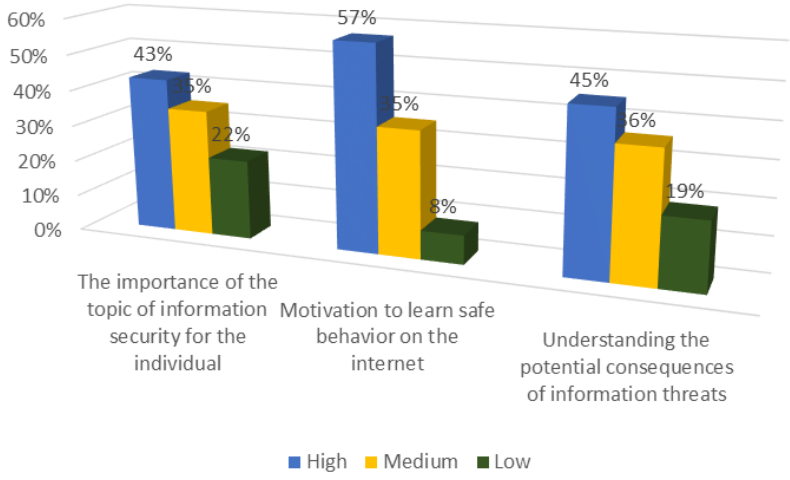

Figure 8 – Results of the assessment of student's indicators according to the motivational criterion related to information security during the control stage

To assess the effectiveness of the project-based method on the development of information-security competencies, an independent-samples *t*-test was conducted for four key criteria: cognitive, emotional-psychological, social, and

motivational. The analysis revealed statistically significant differences between the experimental and control groups for the cognitive ($p < .001$), emotional-psychological ($p = .031$), and social ($p < .001$) dimensions, while the motivational dimension demonstrated a positive but non-significant trend ($p = .057$).

These results indicate that the project-based method produced measurable improvements in students' cognitive understanding, emotional awareness, and social responsibility related to information security. However, motivational changes, although showing upward tendencies, did not reach statistical significance — suggesting that a longer exposure period or additional reinforcement sessions may be needed to consolidate motivational gains.

Table 1. T-test results for assessing the effectiveness of project-based learning on students' information security competencies

№	*Indicator*	*t-value*	*Degrees of freedom (df)*	*Significance (two-tailed)*
1	Cognitive Criterion	3.767	125	p <.001
2	Emotional-psychological criterion	2.180	125	p = .031
3	Social criterion	4.513	125	p <.001
4	Motivational criterion	1.918	125	p = .057

The statistical outcomes summarized in Table 2 were complemented by correlation analysis to explore internal relationships among the assessed dimensions. In addition to group comparisons, a Pearson correlation analysis was performed to examine relationships between students' motivation and cognitive awareness, as well as between social behavior and emotional resilience. The analysis revealed moderate positive correlations: motivation and cognitive knowledge ($r = .61$, $p < .01$), and social skills and emotional stability under informational pressure ($r = .57$, $p < .01$). These results suggest that students who demonstrated greater interest and engagement in the topic also tended to perform better on knowledge-based tasks and to manage informational stress more effectively.

The results of the experimental work demonstrated a positive dynamic in the development of student's competencies in information security through the use of the project-based method. The higher performance of students in the experimental group confirms the effectiveness of this approach. These results are primarily explained by the comprehensive nature of the tasks used during the formative stage. In particular, the task encompassed cognitive, emotional, behavioral, and motivational dimensions.

In contrast, the traditional teaching methods used in the control group, which were mainly focused on the reproductive acquisition of information, showed lower results in the formation of information security skills. This indicated the limitations of traditional approaches in developing critical thinking in information security education.

Current research in the fields of pedagogy and psychology confirms that active learning methods, including project-based, contribute to the development of analytical thinking and the ability to critically perceive information. Thus, the obtained data indicate the need to introduce innovative methods into the educational process that engage the students as an active participant. Project-based fully meets these requirements and appears to be an effective method for the systematic development of information security skills.

From the perspective of the cognitive criterion, it is worth noting that students in the experimental group acquired essential skills such as analyzing information and evaluating the reliability of sources. Observation conducted during the formative stage showed that students demonstrated active engagement while completing project-based tasks. In particular, they achieved high results in performing complex cognitive operations such as structuring and organizing information.

Students' interest in tasks related to information security increased, and it became evident that they began to approach incoming information more carefully. It is important to note that the freedom within the projects and the opportunity for students to express their own opinions enhanced their motivation. Such motivation was directly linked to an understanding of the importance of the learning material related to information security.

However, not all students achieved the same level of results. Although some students actively participated in the project tasks, difficulties were observed in applying information. These results can primarily be explained by individual differences among students, including the level of cognitive development and insufficient internal motivation.

While the research finding confirm the overall effectiveness of the proposed project-based approach, they also highlight the need to further improve the teaching methodology. In particular, adapting project-based to student's individual cognitive characteristics, differentiating tasks, can contribute to the broader development of information security skills. Such an adaptive approach will allow for the more effective realization of the potential of project-based learning and enhance the information security literacy of all students.

The study was limited to one school context and a short intervention period. Future research could expand the sample, include multiple institutions. Nevertheless, the findings demonstrate that integrating project-based activities into school curricula can effectively enhance students' information-security competence and critical engagement with digital environments.

Conclusion

The analysis of scientific literature shows that in today's information society, the influence of the environment on human life, including students' cognitive and behavioral development, is increasing. Incoming information has a dual nature: on the one hand, it broadens students' outlook, while on the other hand, it increases the risk of exposure to information threats and manipulation. In this regard, developing information-security skills in school students has become

one of the key tasks of the modern education system.

Taking into account the rapid development of technologies that transmit information and the growing threats in the digital environment, the main objective of the study was to experimentally assess the effectiveness of using the project-based method to foster the development of information-security skills.

The conducted theoretical analysis, systematic study of previous scientific research, and the results of the pedagogical experiment provide solid grounds to consider project-based learning an effective pedagogical tool for developing school students' information-security skills. The research results demonstrated that this method contributes to the development of essential abilities.

Thus, it can be concluded that the systematic integration of project-based learning into the educational process provides an opportunity for the comprehensive development of secondary-school students' competencies in information security.

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ЖОБАЛЫҚ ОҚЫТУ АРҚЫЛЫ ОҚУШЫЛАРДЫҢ АҚПАРАТТЫҚ ҚАУІПСІЗДІК ҚҰЗЫРЕТТІЛІГІН ҚАЛЫПТАСТЫРУ

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Аңдатпа. Қазіргі заманда цифрлық технологиялардың қарқынды дамуы мен ақпараттық кеңістіктің шексіз кеңеюі жастардың тұлғалық, психологиялық, физиологиялық дамуына, әлеуметтенуіне теріс әсерін тигізіп отырғаны бірқатар ғылыми зерттеулер арқылы дәлелденуде. Жасөспірімдердің интернет желісіндегі жалған ақпаратқа бейімділігі, киберқауіптерге ұшырау қаупі, ақпараттық манипуляцияның ықпалы олардың ақпараттық қауіпсіздігін қамтамасыз ету мәселесін күн тәртібіне шығаруда. Осыған байланысты орта мектеп оқушыларының бойында ақпараттық қауіпсіздік дағдыларын қалыптастырудың өзектілігі артып отыр. Бұл дағдыларға ақпаратты сыни тұрғыдан бағалау, дереккөздердің сенімділігін анықтау, ақпараттық қауіптерді тану және оларға қарсы әрекет ету, цифрлық сауаттылықты және онлайн ортада этикалық мінез-құлықты қалыптастыру жатады. Зерттеуде аталмыш дағдыларды дамытуда инновациялық педагогикалық тәсіл ретінде жобалық-зерттеу әдісінің мүмкіндіктері талданды. Аталған зерттеудің негізгі мақсаты – орта білім беру деңгейіндегі ақпараттық қауіпсіздік дағдыларын қалыптастыру үдерісінде жобалық-зерттеу әдісінің педагогикалық тиімділігін анықтау.

Зерттеу барысында авторлар ақпараттық қауіпсіздік саласына қатысты ғылыми әдебиеттерге теориялық талдау жүргізіп, жобалық-зерттеу әдісінің жалпы білім беру тәжірибесінде кеңінен қолданылып келе жатқанына қарамастан, оның ақпараттық қауіпсіздік дағдыларын дамытудағы рөлі жүйелі түрде зерттелмегені анықтады. Осыған байланысты эксперименттік жұмыс ұйымдастырылды және нәтижелері статистикалық талдаудан өткізілді.

Алынған нәтижелер негізінде орта мектеп оқушыларын оқыту барысында ақпараттық қауіпсіздік дағдыларының оқушы тұлғасының маңызды сапалық компоненті екені атап көрсетілді. Бұл дағдыларды білім беру жүйесінде мақсатты түрде қалыптастыру үшін жобалық-зерттеу әдісін тиімді қолдану қажеттігі жөнінде ғылыми негізделген тұжырым жасалды. Зерттеу барысында алынған қорытындылар орта мектеп оқушыларына арналған оқу жоспарлары мен бағдарламаларын әзірлеу ісіне теориялық әрі әдістемелік негіз бола алады.

Тірек сөздер: ақпараттық қауіпсіздік, жобалық-зерттеу әдісі, орта мектеп оқушылары, цифрлық құзыреттілік, педагогикалық тиімділік, эмоционалды-психологиялық жағдай, инновациялық оқыту әдістері, сыни тұрғыдан ойлау.

ФОРМИРОВАНИЕ КОМПЕТЕНЦИИ ИНФОРМАЦИОННОЙ БЕЗОПАСНОСТИ УЧАЩИХСЯ СРЕДСТВАМИ ПРОЕКТНОГО ОБУЧЕНИЯ

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Аннотация. В настоящее время ряд научных исследований указывает на то, что стремительное развитие цифровых технологий и бесконечное расширение информационного пространства оказывают негативное влияние на личностное, психологическое и физиологическое развитие и социализацию молодежи. Склонность подростков к дезинформации в интернете и воздействие информационных манипуляций выдвигают на первый план проблему обеспечения их информационной безопасности. В этой связи возрастает значение развития у школьников навыков информационной безопасности. К таким навыкам относятся умение критически оценивать информацию, определять надежность источников, распознавать информационные угрозы и противодействовать им, формирование цифровой грамотности и этического поведения в онлайн-среде.

В данной статье анализируются возможности проектно-исследовательского метода как инновационного педагогического подхода к развитию указанных навыков. Основная цель исследования — определить педагогическую эффективность проектно-исследовательского метода в процессе формирования навыков информационной безопасности на уровне среднего образования.

В ходе исследования проведен теоретический анализ научной литературы в области информационной безопасности, и установлено, что, несмотря на широкое применение проектно-исследовательского метода в общеобразовательной практике, его роль в развитии навыков информационной безопасности системно не изучалась. В этой связи было проведено экспериментальное исследование, результаты которого подверглись статистическому анализу.

На основании полученных данных подчеркивается, что навыки информационной безопасности в учебном процессе учащихся средней школы являются важной качественной составляющей личности ученика. Сделан вывод о необходимости эффективного применения проектно-исследовательского метода для целенаправленного формирования данных навыков в системе образования. Полученные в ходе исследования выводы могут служить теоретико-методологической основой для разработки учебных планов и программ для учащихся средней школы.

Ключевые слова: информационная безопасность, проектно-исследовательский метод, учащиеся средней школы, цифровая грамотность, педагогическая эффективность, эмоционально-психологическое состояние, инновационные методы обучения, критическое мышление.

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