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# Uso de los teléfonos inteligentes para mejorar la participación cognitiva creativa en el aprendizaje estudiantil: un estudio de caso

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**Resumen.** El estudio examina las perspectivas de utilizar teléfonos inteligentes como instrumento de aprendizaje. El documento reporta los resultados de un estudio orientado al sujeto sobre las características personales y de género de cómo los estudiantes de secundaria general (grados 8-9) perciben la posibilidad de dominar competencias transversales utilizando teléfonos inteligentes como el medio más común de aprendizaje independiente/a distancia. El objetivo de la investigación se persigue mediante una encuesta que evalúa 23 descriptores de competencias transversales en términos de la posibilidad de su desarrollo utilizando teléfonos inteligentes. Los resultados de la encuesta también se analizan por género. El análisis indica las competencias transversales que los encuestados creen que se promueven utilizando teléfonos inteligentes y las competencias que dudan que se puedan desarrollar utilizando teléfonos inteligentes. Con base en las ventajas y desventajas de los teléfonos inteligentes para el dominio de las competencias transversales, los autores proponen conclusiones orientadas a la práctica que se pueden utilizar en recomendaciones metodológicas sobre métodos, instrumentos y medios efectivos para desarrollar y evaluar competencias transversales.

**Palabras clave:** competencias transversales, smartphone, herramienta de aprendizaje, resultados del aprendizaje, diferencias de género.

## Using smartphones to enhance creative cognitive engagement in student learning: a case study

**Abstract.** The study examines the prospects of using smartphones as a learning instrument. The paper reports on the results of a subject-oriented study of the personal and gender-specific characteristics of how general secondary school students (grades 8-9) perceive the possibility of mastering transversal competencies using smartphones as the most common means of independent/distance learning. The research goal is pursued using a survey assessing 23 descriptors of transversal competencies in terms of the possibility of their development using smartphones. The survey results are additionally analyzed by gender. The analysis indicates the transversal competencies that respondents believe to be promoted using smartphones and the competencies that they doubt can be developed using smartphones. Based on the advantages and disadvantages of smartphones for mastery of transversal competencies, the authors propose practice-oriented conclusions that may be used in methodological recommendations on effective methods, instruments, and means of developing and accessing transversal competencies.

**Key words:** transversal competencies, smartphone, learning tool, learning outcomes, gender differences.

### INTRODUCTION

The general trends of the pervasive introduction of information and communications technology (ICT) (Abdullaev et al., 2023a, 2023b) stimulate the attention of the scientific and pedagogical community to the use of Internet technologies, resources, and communication platforms in education (Kozhomuratova et al., 2024).

Recent research suggests that as of April 2024, school and university/college students constitute the largest share (98%) of regular Internet users in Russia (Levada-Center, 2024); 92% of school students aged 14-17 use the Internet constantly (Stogova, 2023). The leading type of device to access the web used by the overwhelming majority of Russian school students, is a smartphone. Most students aged 14–17 (92%) have their own smartphones with Internet access (Stogova, 2023). Among other devices used for learning (laptops, tablets), the majority of school students give preference to smartphones (64%) (Stogova, 2023).

The opportunity to use smartphones as a learning tool is provided by their functions correlating with those of a personal computer: managing MS Office files, searching for information on the Internet, using educational applications, applications for text and graphic messaging and video, and communication (social networks) and educational platforms, reading e-books and documents, etc. (Vasilev et al., 2020; Balova et al., 2022). However, the process and results of using a smartphone as a learning tool require comprehensive study (Kostromina et al., 2022; Knyazeva et al., 2024).

The relevance of the study on the effectiveness of smartphones in realizing educational goals stems from several interrelated aspects:

- 1) The spread of organized (by the teacher) (Avdeeva et al., 2022) and unorganized (by individual students) use of smartphones, which during the COVID-19 pandemic was associated with the crisis learning conditions that influenced the educational process organization and caused the need to use ICT for distance and blended learning (Borodina et al., 2022).

- 2) The need for a comprehensive evidence-based (empirically proven) description of the advantages and disadvantages of smartphone use related to learning outcomes. Transversal competencies are subject to assessment and recording of teachers' observation of their development in students as evidence of learning achievements (Elistratova et al., 2021). Research associated with the search for effective methods and means of developing and accessing subject-specific and transversal learning outcomes is urgent (Gabidullina et al., 2023).

A topical direction of research to determine the influence of certain tools on the qualitative indicators and learning results is the study of students' opinions (as active users) regarding the effectiveness of their application. Since the student is the final addressee of the system of pedagogical influences in the paradigm of person-centered learning, their opinion reflects the effectiveness of the system's influence (in the context of our research problem – the influence of smartphones). Understanding students' digital behaviors in achieving their learning goals will help identify the advantages and disadvantages of using smartphones as learning tools and raise awareness among stakeholders in education about the productive strategies of using smartphones in the educational process.

## LITERATURE REVIEW

Publications on the use of smartphones for learning purposes cover various aspects (Pivneva et al., 2022; Nikolaeva et al., 2024). Several studies focus on the methodological and instrumental aspects, exploring the benefits of the constructive use of smartphones for mobile learning (Harrison et al., 2013; Diliberto-Macaluso & Hughe, 2016), personalized learning (Steel, 2012), self-regulated learning (Sha et al., 2012), and the delivery of lessons (Klimova, 2017; Soekamto et al., 2022). Most studies analyze the advantages of using smartphones: the portability of the devices; the flexibility of learning (the ability to learn irrespective of time and place); the expansion of learning environments and models (including didactic methods) due to the device's instruments (constructive use of camera functions, access to the Internet as an opportunity to install learning applications and use online platforms and services, which facilitates the organization of independent, personalized, and differentiated learning); organization of controlled cooperation between students and between students and the teacher; continuous exchange of information of any format, etc.

The problems of using smartphones in teaching are covered from a methodological and instrumental perspective: the difficulty of controlling the use of applications (distraction by non-educational content, exchange of entertainment messages); safe behavior on the Internet and cyberbullying (Gapsalamov et al., 2020); lack of awareness of the importance of teachers utilizing smartphones in instruction; media literacy (Alwraikat, 2017; Deniza et al., 2017; Gapsalamov et al., 2020).

A psychological and pedagogical view of the problem is considered in research focusing on determining the influence of smartphones on the psychological features of students' learning activity and the quality of learning outcomes (Chen & Zan, 2016; Hochberg et al., 2018). A review by O.J. Sunday et al. (2021) systematizes works that show positive and negative consequences of smartphone use. Researchers prove that excessive use of mobile devices has a negative impact on students' learning achievements (Lepp et al., 2015). Scientists attribute the decline in learning outcomes to the disruption of discipline and decreased concentration, explained by the multitasking capabilities of smartphones leading to uncontrolled shifts of attention between different activities and the effect of distraction (Roberts et al., 2014). E. Sumuer and D.N. Kaçıkci (2022) prove the influence of the multifunctionality of smartphones on the emergence of the mental phenomenon of "mind-wandering" in students when using devices in the learning process (the emergence of non-task-related

opinions). Attention deficit and distraction while studying can lead to issues with working memory inhibition (reduced speed and performance of information encoding, storage, and retrieval makes it difficult to recall the necessary information at the right moment, for example, at exams). R. Lavoie and Y. Zheng (2023) argue that the same functions of smartphones can have a positive effect on some users and a negative effect on others.

J.K. Nayak (2018) identifies gender differences in the impact of smartphones on learning outcomes. Specifically, their impact on learning outcomes is more significant for male students, who show signs of dependence on smartphones. Smartphones affect the development of attention deficit in teenage girls and their self-control, whereas teenage boys only demonstrate a significant influence of smartphones on the concentration of attention.

Several papers also argue for the positive results of using smartphones in training. B. Dos (2015) finds a positive relationship between mobile phone use and learning achievements and between smartphone use and metacognitive awareness (consciousness). The study shows that smartphones promote students' interest in learning and curiosity. B. Klimova (2018) and P. Ling et al. (2023) report findings regarding the influence of mobile devices on motivation for learning. The authors prove that mobile applications adapted to the relevant educational level stimulate students to learn in a specially organized environment during lessons and after school hours, especially with timely feedback.

Y. Lin et al. (2021) prove that the impact of smartphones is unclear and depends on the type of applications used. The authors demonstrate that the proper use of educational applications positively affects academic achievements, while the use of gaming applications, social media, music, video, and entertainment have a negative effect on the learning quality and results, additionally contributing to the development of nomophobia (fear of inaccessibility of smartphones).

Most analyzed studies are object-oriented (disclosing the observed phenomenon based on analyzing qualitative characteristics and the obtained learning results). To fully unravel the issue, it is important to study the subjective opinion of the users of smartphones as a means of learning. It is necessary to conduct subject-oriented research aimed at exploring students' personal opinions regarding the effectiveness of smartphone use based on their user experience. Our research is aimed at exploring the personal perceptions of 8th-9th grade students on the possibility of mastering transversal competencies using smartphones.

The article reports the results of a subject-oriented study of the personal and gender features of the perceptions of general secondary school students regarding mastering transversal competencies using smartphones as the most common means of independent/distance learning.

## METHODS

At the first stage of the research, the sources of information necessary for the realization of the research objective were selected. The data for this study were represented by monographs, as well as articles and reviews published in journals indexed by Scopus and Web of Science. Based on the analysis of the source base, the problems and prospects of using smartphones for educational purposes were identified.

At the second stage, an expert survey aimed at determining the most significant transversal competencies for general secondary school students was carried out. The sample size of 44 experts was determined to be sufficient, and the selected participants were e-mailed proposals to take part

in the survey. The criterion for the selection of experts was the presence of at least three publications on the research problem in peer-reviewed journals. A total of 40 people agreed to participate in the survey, after which they were sent e-mails with questions. Based on the received answers, the most significant transversal competencies of general secondary school students were identified.

At the third stage, the survey method was applied to investigate students' assessment of smart-phones as a means of mastering transversal competencies. The study involved 157 students of 8th (N=86) and 9th (N=70) grades with equal gender distribution.

The survey was conducted in person during the educational process. In the course of the survey, the respondents did not receive any external evaluation regarding the correctness of their assessments of the questions offered in the questionnaire. The questionnaire, developed by us, contained 23 items – the descriptors of transversal competencies determined at the previous stage, which were evaluated by the degree of agreement with the proposed statement on an ordinal Likert scale (5 being the maximum degree of agreement). The transversal competencies were grouped into content clusters, which were also used to group their respective descriptors (Table 1).

**TABLE 1.** Description of transversal competency clusters (by content)

Transversal competency clusters	Indexed descriptors of transversal competencies
1. Text processing	1.1. Analyzing artistic texts 1.2. Analyzing scientific texts 1.3. Analyzing mass media texts 1.4. Analyzing graphs, figures 1.5. Creating charts, figures, tables 1.6. Finding the information needed to complete the task (word interpretations, rules, algorithms for tasks, templates) 1.7. Checking the correctness of completed tasks
2. Thinking: critical, systemic, creative	2.1. Making conclusions and proving them orally 2.2. Making conclusions and proving them in writing 2.3. Comparing different opinions and views 2.4. Recognizing reliable and unreliable information 2.5. Writing creative works, pieces of writing
3. Interaction	3.1. Interacting (cooperating) with others (when performing group tasks) 3.2. Planning teamwork in completing shared tasks
4. Argued statement of own opinion	4.1. Expressing one's opinion and proving it orally 4.2. Expressing one's opinion and proving it in writing 4.3. Writing a formal letter to a specific institution or organization
5. Decision-making	5.1. Making a decision while anticipating and considering possible consequences 5.2. Finding ways to solve problems 5.3. Evaluating a task completed independently 5.4. Evaluating tasks completed by classmates

Answering the questionnaire, students used their experience to assess the productivity of smart-phones in various activities and the development of relevant competencies during their studies.

The results were processed using statistical methods in IBM Statistica 10. The ranking of students' assessments was compiled based on the list of descriptors of transversal competencies (the right column in Table 1).

## RESULTS

The ranking of the characteristics of smartphone effectiveness based on the assessments of male and female students is presented in Table 2.

**TABLE 2.** Ranking of respondents' assessments by gender

Girls		Boys	
Transversal competencies	M	Transversal competencies	M
1.6. Finding the information needed to complete the task	4.49*	1.7. Checking the correctness of completed tasks	4.28*
1.7. Checking the correctness of completed tasks	4.40*	2.4. Recognizing reliable and unreliable information	4.17*
4.3. Writing a formal letter to a specific institution or organization	4.40*	1.2. Analyzing scientific texts	4.13*
1.3. Analyzing mass media texts	4.38*	1.6. Finding the information needed to complete the task	4.11*
2.5. Writing creative works, pieces of writing	4.27*	5.3. Evaluating a task completed independently	4.01*
2.4. Recognizing reliable and unreliable information	4.24*	1.4. Analyzing graphs, figures	4.00*
1.4. Analyzing graphs, figures	4.17*	2.5. Writing creative works, pieces of writing	3.97
1.2. Analyzing scientific texts	4.10*	1.1. Analyzing artistic texts	3.96
1.5. Creating charts, figures, and tables	4.10*	1.5. Creating charts, figures, and tables	3.93
2.2. Making conclusions and proving them in writing	4.09*	2.1. Making conclusions and proving them in writing	3.93
5.3. Evaluating a task completed independently	4.09*	4.3. Writing a formal letter to a specific institution or organization	3.93
5.4. Evaluating a task completed by classmates	4.05*	1.3. Analyzing mass media texts	3.89
1.1. Analyzing artistic texts	3.97	4.2. Expressing one's opinion and proving it in writing	3.88
4.2. Expressing one's opinion and proving it in writing	3.97	3.1. Interacting (cooperating) with others	3.86
2.1. Making conclusions and proving them orally	3.94	5.4. Evaluating a task completed by classmates	3.86

**TABLE 2. Continuación**

Girls		Boys	
Transversal competencias	M	Transversal competencias	M
3.2. Planning teamwork in completing shared tasks	3.90	5.2. Finding ways to solve problems	3.82
5.2. Finding ways to solve problems	3.87	2.2. Making conclusions and proving them orally	3.78
5.1. Making a decision while anticipating and considering possible consequences	3.78	2.3. Comparing different opinions and views	3.76
2.3. Comparing different opinions and views	3.74	5.1. Making a decision while anticipating and considering possible consequences	3.71
4.1. Expressing one's opinion and proving it orally	3.68	4.1. Expressing one's opinion and proving it orally	3.64
3.1. Interacting (cooperating) with others	3.58	3.2. Planning teamwork in completing shared tasks	3.58

\*positive assessment of the possibility of mastering the competency.

According to students, smartphones are the most effective tool for mastering competencies related to information search and analysis. The least productive use of smartphones, in students' view, is developing the competency of expressing and proving one's opinion orally.

Table 3 demonstrates differences in the mean values of students' rating of the characteristics of smartphone use (gender differences in students' ratings).

**TABLE 3.** Difference between the mean values of the ranking score of smartphone usage options (girls/boys)

Transversal competencias	M		Difference in mean values
	Girls	Boys	
1.1. Analyzing artistic texts	3.97	3.96	0.01
1.2. Analyzing scientific texts	4.10*	4.13*	-0.03
1.3. Analyzing mass media texts	4.38*	3.89	0.49
1.4. Analyzing graphs, figures	4.17*	4.00*	0.17
1.5. Creating charts, figures, and tables	4.10*	3.93	0.17
1.6. Finding the information needed to complete the task (word interpretations, rules, algorithms for tasks, templates)	4.49*	4.11*	0.38
1.7. Checking the correctness of completed tasks	4.40*	4.28*	0.12
2.1. Making conclusions and proving them orally	3.94	3.93	0.01
2.2. Making conclusions and proving them in writing	4.09*	3.78	0.31
2.3. Comparing different opinions and views	3.74	3.76	-0.02
2.4. Recognizing reliable and unreliable information	4.24*	4.17*	0.07
2.5. Writing creative works, pieces of writing	4.27*	3.97	0.3



TABLE 3. Continuación

Transversal competencies	M		Difference in mean values
	Girls	Boys	
3.1. Interacting (cooperating) with others (when performing group tasks)	3.58	3.86	-0.28
3.2. Planning teamwork in completing shared tasks	3.90	3.58	0.32
4.1. Expressing one's opinion and proving it orally	3.68	3.64	0.02
4.2. Expressing one's opinion and proving it in writing	3.97	3.88	0.09
4.3. Writing a formal letter to a specific institution or organization	4.40*	3.93	0.47
5.1. Making a decision while anticipating and considering possible consequences	3.78	3.71	0.07
5.2. Finding ways to solve problems	3.87	3.82	0.05
5.3. Evaluating a task completed independently	4.09*	4.01*	0.09
5.4. Evaluating tasks completed by classmates	4.05*	3.86	0.19

\*positive assessment of the possibility of mastering the competency.

Table 3 shows that girls generally gave high scores to the assessed characteristics. The most significant differences in the ratings, where there is an advantage in the ratings of girls, are observed with respect to the following characteristics of activity: "Analyzing mass media texts", "Writing creative works, pieces of writing", "Finding the information needed to complete the task", "Writing a formal letter to a specific institution or organization", and "Planning teamwork in completing shared tasks". A significant advantage in the estimations of boys is observed only in the characteristic of "Interacting (cooperating) with others".

## DISCUSSION

In the process of actively using a smartphone as a learning tool, the student develops their own attitude to this instrument. Accordingly, a system of indicators expressed in the subject's assessment of the learning tool develops. It can be argued that above-average ratings by students (average = 3.9 out of 5 points) indicate their interpretation of smartphones as an important learning tool. However, our survey results and the analyzed studies reviewing the educational opportunities offered by smartphones (Hochberg et al., 2018; Lavoie & Zheng, 2023) indicate that in the eyes of students the use of smartphones becomes situational and passively consumerist. Our survey suggests that students believe smartphones to be effective in developing the competencies of searching, analyzing, and using educational information. On the other hand, there is not much confidence in the smartphone-aided development of the competencies of productively interacting with others and expressing one's opinion (orally).

Summarizing the reported results, we should note that the student's subjective assessment of the influence of smartphones on their learning outcomes, formed in the course of their personal experience using the device, characterizes the consciousness of their attitude to smartphones and affects the way students' learning activities are shaped. The learned modes of activity form the im-

peratives of behavior and thinking style and influence the subject's decision-making in studies and other situations (Dos, 2015). Considering our results, we can assert the following:

The relevance of developing methodological materials to unlock the potential of smartphones as learning tools used for students' active creative cognitive activities (manifested in the transversal competency clusters "Interaction", "Argumented statement of own opinion", and "Decision-making"), which is of particular importance in the era of the global digitalization of education; developing a system of group tasks to be performed using smartphones (including scenario-based, project-based approach (Mukhametkairov et al., 2024), etc.);

The need to account for gender differences in organizing constructive interaction between students: creating comfortable conditions for the activity, initiative, and self-expression of students of both genders and the development of their social intelligence (productive manipulation of information, the expression and argumentation of one's opinion, proving the correctness or inaccuracy of conclusions, etc.); creating opportunities for meaningful student communication based on gender balance (Roberts et al., 2014) (engaging students of both genders in working in mixed groups to accomplish shared tasks using smartphone software);

The expediency of the results of the present study (certain generalized perceptions of students about the effectiveness of using smartphones for the formation and development of transversal competencies and the significance of these competencies) in the context of a differentiated approach to teaching methods and the methods of assessing learning outcomes: e.g., considering students' perceptions of the effectiveness of smartphones to handle educational information in the organization of work on a certain task and the choice of learning strategies. In the aspect of the difficulty of assessing transversal competencies, we consider this approach promising, although it does require further research.

## CONCLUSION

Our research used the instrumental and differentiated approaches to transversal competencies as learning outcomes common to all subjects, specifically subjects' assessment of the effectiveness of using smartphones to achieve common educational goals, and the identification of gender differences: 1) in students' understanding of the components of transversal competencies and their importance; 2) in assessments of possibilities for mastering transversal competencies using smartphones.

Our results prove the need to consider the specifics of mobile learning in the organization of the pedagogical process and the recommendations developed through the study of this phenomenon, particularly successful practices and technologies for the introduction of smartphones in learning, as well as raising students' awareness of the productive use of smartphones for the development of emotional intelligence, teamwork skills, etc.

The identification of the advantages and disadvantages of smartphones to master transversal competencies will allow to consider them when developing methodological recommendations on effective methods, tools, and means of their development and assessment. Given the ambiguity of the results of scientific research, the constant development of smartphone technologies and software, and the corresponding changes in the organization of students' learning activities, further investigation of these issues remains relevant and requires systematic research.

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