# METHODOLOGY FOR DEVELOPING METACOGNITIVE SKILLS IN GRADES 10-11 THROUGH DIGITAL INTERACTIVE TASKS

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**Abstract**: This article analyzes the pedagogical possibilities of digital interactive tasks in forming metacognitive skills in 10th-11th grade students of general education schools from scientific-theoretical and practical perspectives. The study reveals the essence of the concept of metacognition, its structural components (planning, monitoring, reflection), and its role in the educational process. Additionally, mechanisms are being developed to develop students' competencies in independent thinking, self-control, and learning activity management through interactive tasks (online platforms, tests, simulations, gamification elements) in the digital educational environment.

**Keywords**: metacognitive skills, digital education, interactive tasks, self-control, reflection, monitoring, gamification, independent thinking

## Introduction

Today, the main task of the educational process is not only to convey ready-made knowledge to the student, but also to form them as an independent thinker, capable of consciously managing their activities, analyzing information, and using it purposefully. This process is particularly important for students in grades 10-11. Because at this stage, a student faces such responsible processes as completing general secondary education, choosing a profession, preparing for higher education, and making independent life decisions. In such conditions, it becomes a special pedagogical necessity for the student not only to possess knowledge but also to understand how they are learning, to assess their level of knowledge, to be able to see their mistakes, and to be able to independently choose an educational strategy. It is these aspects that are directly related to the concept of metacognitive skills.

Metocognitive skills refer to the student's ability to establish conscious control over their thinking, cognitive process, and learning activities. In other words, it is the student's self-analysis and management of their educational activities based on questions such as "what do I know?," "what don't I know?," "how do I learn better?," "what are my mistakes?," "how can I improve my results?." A student with metacognitive skills is not a passive listener during the lesson, but an active participant, inclined to research, critical thinking, and a subject striving for self-development.

The widespread implementation of digital technologies in the modern education system is opening up new opportunities for the formation of metacognitive skills. Today's student lives in a digital environment and receives information primarily through electronic sources, online platforms, multimedia tools, and interactive programs. Therefore, the educational process must be organized in harmony with the student's modern information environment. Digital interactive tasks differ from traditional tasks in that they encourage the student to be active, observe their own actions during the task execution process, quickly evaluate the result, work on mistakes, and serve solid learning through retrying.

An important advantage of digital interactive tasks is that they allow the student to receive immediate feedback. For example, through online tests, interactive questions, spreadsheets and diagrams, virtual problem situations, gamified exercises, or reflexive tasks, the student sees whether their answer is correct or incorrect, identifies an error, and seeks ways to correct it. This process is not simply a test of knowledge, but rather directs the student toward understanding, planning, monitoring, and evaluating their own learning. Thus, digital interactive tasks manifest as a practical tool for metacognitive development.

The formation of metacognitive skills in grades 10-11 is particularly relevant. This is because at this age, students have a growing need to make independent decisions, justify their opinions, choose a career path, sort through complex information, and set their own educational goals. However, in practice, many students lack sufficient independence in skills such as accurately assessing their level of knowledge, planning educational tasks, correctly allocating time, systematically working on errors, and analyzing results. This necessitates the development of a methodology based on a metacognitive approach in the educational process.

From this perspective, the methodology for forming metacognitive skills using digital interactive tasks is one of the important directions of modern pedagogy. This methodology serves to personalize the student's learning process, take into account their individual learning pace and abilities, prepare them for independent learning, and enhance their digital literacy. In particular, reflexive questions, electronic portfolios, self-assessment sheets, online problem-solving tasks, interactive tests, and digital project work can be effective tools for developing a student's "learning to learn" competence. In the context of a digital educational environment, the issue of forming metacognitive skills is of not only methodological but also socio-pedagogical importance. Because today's society needs young people who can work on themselves, do not lose their direction in the flow of information, constantly update their knowledge and find independent solutions to problems. Digital interactive tasks serve as an effective pedagogical tool for educating such a person.

Review of research

In recent years, the issue of forming metacognitive skills has been extensively researched in connection with the student's ability to manage their knowledge, self-control, planning, and reflection in the educational process. In particular, digital educational tools, interactive platforms, gamification, online tests, and electronic feedback systems are evaluated as effective pedagogical tools in this process.

Education Endowment Foundation - "Metacognition and Self-Regulated Learning." This manual provides practical recommendations for developing metacognition and self-directed reading skills at the primary and secondary levels of education. The source indicates that the main stages of metacognitive learning are understanding the learning goal, choosing a strategy, monitoring activities, and evaluating results. This approach serves as a theoretical basis for forming "learning to learn" competence in 10th-11th grade students through digital interactive tasks.

Désirée Delia Diana Fahrni, Glena Iten, Doreen Prasse, Tina Hascher - "Teachers' practices in the use of digital technology to promote students' self-regulated learning and metacognition." This systematic review, published in 2025, analyzes the practices of teachers in K-12 education to develop self-regulation and metacognitive skills in students using digital

technologies. The authors studied 45 studies and emphasize that digital feedback systems, learning dashboards, artificial intelligence, and electronic assignments enhance students' planning, observation, and assessment processes.

X. Geng et al. - "The effects of different metacognitive patterns on students' self-regulated learning in blended learning."

This study examines how patterns of metacognitive activity affect students' self-directed learning processes within a blended learning environment. The authors found that metacognitive monitoring, strategic planning, and step-by-step task execution in a blended learning environment increase the effectiveness of students' independent learning.

H. Wang - "Insights into online learners' metacognitive abilities" This 2025 study analyzes the metacognitive abilities of online learners through explainable artificial intelligence technologies. According to the research findings, students with high metacognitive skills focus more on goal setting, understanding content, and a strategic approach rather than simply completing a task. This conclusion indicates the need for reflexive questions, self-assessment, and the creation of an individual metacognitive profile in digital interactive tasks.

Sadykova and co-authors - "The impact of a metacognition-based course on school students' metacognition and biology comprehension"

This article, published in the journal Frontiers in Education, examines the impact of a 10-week metacognitive biology course on the metacognitive development of schoolchildren and their understanding of the content of science. The research results demonstrate that the systematic inclusion of metacognitive strategies in science lessons enhances not only the student's knowledge but also their level of awareness of their own learning activities.

R. K. Verma, S. Gupta - "Metacognitive Abilities on E-Learning Outcomes among Senior Secondary School Students: A Comparative Analysis across School Types" This study, published in 2024, analyzes the attitudes and metacognitive abilities of high school students in India toward e-learning. A study involving 580 students shows that digital learning outcomes are directly linked to metacognitive abilities. This resource is important for substantiating the importance of electronic assignments, online platforms, and remote tasks in metacognitive development in grades 10-11.

Melis Yeşilpınar Uyar - "Metacognitive Strategies and Tendency to be Open to Learning: A Predictive Study" This 2024 article analyzes the relationship between metacognitive strategies and openness to learning. According to the author's conclusion, as a student learns to plan and control their cognitive activity, their inclination to accept new knowledge, draw conclusions from mistakes, and conduct independent research increases.

S. D. Lksana et al. - "The Effect of the Use of Digital Gamification and Metacognitive Skills on Mathematical Problem-Solving" This 2024 experimental study examined the impact of digital gamification and metacognitive skills on the ability to solve mathematical problems. The research results demonstrate that game elements, step-by-step tasks, immediate feedback, and a result tracking system activate students' critical and creative thinking.

The analyzed studies show that the development of metacognitive skills in recent years has been studied in close connection with digital education, interactive tasks, self-directed learning, gamification, and artificial intelligence tools. In general, researchers emphasize that for digital technologies to be effective, they should be used not as a simple means of conveying information,

but as a pedagogical mechanism that encourages students to plan, monitor, analyze, evaluate, and reflect. Therefore, it is advisable to organize the methodology for forming metacognitive skills in 10th-11th grade students based on digital interactive tasks, reflective questions, electronic portfolios, online tests, gamified tasks, and individual feedback.

Discussion

In the context of a digital educational environment, the issue of fostering metacognitive skills in 10th-11th grade students is regarded as one of the critical directions of modern pedagogy. Because today's student is not only a person who assimilates the information in the textbook, but also a subject who receives independent knowledge through various digital sources, online platforms, multimedia tools and interactive tasks. In such conditions, it is not the volume of knowledge that is important, but how the student manages the process of acquiring knowledge, how they correct their mistakes, and what strategy they choose to achieve the learning goal. Therefore, the development of metacognitive skills should be interpreted as an integral part of digital education.

The theoretical approaches examined within the framework of the article indicate that metacognitive skills shape a student's conscious attitude toward their cognitive activity. Before completing the task, the student plans it, observes their own activity during the process, evaluates the result, and draws conclusions for further activity. It is these processes that can be organized more effectively through digital interactive tasks. This is because digital tasks provide the student with rapid feedback, show the result, allow for the identification of errors, and encourage them to try again. This creates a natural mechanism of metacognitive activity.

In the process of traditional education, the student often completes the assignment given by the teacher and waits for the grade. In digital interactive tasks, the evaluation process is not limited to the final result. During the task, the student checks their answers, sees their mistakes, and searches for paths leading to the correct solution. For example, online tests, interactive exercises, electronic portfolios, reflexive questionnaires, gamified tasks, and virtual problem situations encourage students to make independent decisions. This process serves to understand and manage one's own educational activities rather than the mechanical acquisition of knowledge.

The development of metacognitive skills is particularly important for students in grades 10-11. Because at this age, students face important tasks such as preparation for higher education, career choice, independent study, time management, and personal development. If a student knows their strengths and weaknesses, is able to understand which topic they have mastered well, and in which direction additional work is necessary, their educational activity will be more purposeful and effective. Thus, digital interactive tasks at this stage serve as an important tool not only for mastering the content of the subject but also for preparing the student for independent learning.

One of the aspects that must be paid special attention to during the discussion is that digital technologies do not provide educational efficiency on their own. Any digital tool yields effective results only when it is combined with a pedagogical goal, a methodological system, and a didactic plan. If an interactive task is organized solely in the form of a test or the selection of a ready-made answer, it may not have a sufficient impact on metacognitive development. In contrast, a task becomes a true metacognitive task when it forces the student to think about questions such

as “why did I choose this answer?,” “what mistake did I make?,” “what strategy will I use next time?.”

From this perspective, the effectiveness of digital interactive tasks is determined by their reflexive content. After each task, the student must evaluate their performance, analyze the results, identify the causes of the difficulties, and determine the next learning steps. For example, through an electronic portfolio, a student collects their work, test results, project assignments, and personal opinions. This helps them track the dynamics of their own development. Self-assessment sheets guide the student not only toward obtaining grades but also toward the conscious analysis of their own knowledge.

The role of the teacher in developing metacognitive skills through digital interactive tasks will also change. The teacher is no longer merely a knowledge provider, but also a facilitator who creates conditions for students to think independently, plan, and analyze their activities. It selects tasks, organizes a digital environment, provides guidance to students, and encourages them to reflect through questions. The teacher’s methodological skills are of decisive importance here. Because it is the teacher who determines how the digital tool is used, at what stage it is given, which questions are reinforced, and how it is evaluated.

Elements of gamification are also important in the formation of metacognitive skills in students. Elements such as score, level, rating, reward, step-by-step task, and quick result increase student motivation. However, gamification should not be limited to competition in the form of games. Its main pedagogical task should be to guide the student to observe their own results, compare them with previous results, and analyze the causes of success and mistakes. Only then will gamification become a means of metacognitive development. Another important aspect of the topic under discussion is the formation of an individual educational trajectory. Digital platforms allow for recording student performance, identifying topics of difficulty, and providing personalized recommendations. This is very necessary in the process of independent preparation for students in grades 10-11. For example, if a student sees which types of assignments they make the most mistakes in, they will choose their next learning strategy accordingly. As a result, the educational process is organized not in a general and uniform direction, but in accordance with the individual needs of the student.

In addition to metacognitive skills, digital interactive tasks develop critical thinking, problem situation analysis, information sorting, and logical inference making skills. This is because interactive tasks encourage the student not to choose an answer from several options, but to justify the choice, substantiate their opinion, and evaluate the result. Especially in high school, students’ independent thinking is developed through problem-based questions, digital cases, project assignments, and analytical tasks.

Furthermore, digital interactive tasks serve as an important factor in increasing students’ learning motivation. The modern student is more adapted to an educational environment that is visual, fast, interactive, and shows immediate results. If digital tools are used meaningfully and purposefully during the lesson, the student’s interest in the lesson will increase. However, this interest should not remain only at the level of external motivation. Through a metacognitive approach, the student gains internal motivation by improving their results, working on themselves, and seeing their educational growth.

In the process of analyzing the topic, some problems are also noticeable. In particular, not all schools have the same digital technical capabilities. The quality of the Internet, the availability of computers and tablets, the digital competence of teachers, and the culture of students' targeted use of technology can vary. Therefore, when implementing digital interactive tasks, it is important to take existing conditions into account, use simple and convenient platforms, and direct tasks toward a specific pedagogical goal rather than a complex technical process. Furthermore, it should be remembered that the formation of metacognitive skills is a long-term and systemic process. One or two interactive tasks do not form a strong reflexive thinking in the student. To achieve this, metacognitive questions, digital analysis tools, and self-assessment elements should be consistently applied at various stages of the lesson - starting a new topic, reinforcing it, independent work, assessment, and homework. Systematicity, stages, and repetitive reflection are the main conditions of this methodology. The methodology for forming metacognitive skills in 10th-11th grade students through digital interactive tasks elevates the educational process to a qualitatively new level. This approach forms the student not as a consumer of knowledge, but as an active subject who creates, manages, and evaluates their own knowledge. As a student begins to understand their learning process, their independent thinking, responsibility, self-confidence, and learning outcomes also increase.

Conclusion

The results show that digital interactive tasks are an effective pedagogical tool for forming metacognitive skills, activating students' activities in planning, monitoring, self-assessment, and reflection. However, this effectiveness depends not on the digital tool itself, but on its methodologically correct design, targeted management by the teacher, and the active participation of the student. Therefore, in the future, developing methodological models for digital tasks across disciplines, evaluating their effectiveness through experimental testing, and creating a system of practical recommendations for teachers will remain an important scientific and practical task in this direction.

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