



Didactic Possibilities For Developing Logical Thinking Skills In A Digital Learning Environment

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Abstract. This article analyses the didactic possibilities and pedagogical conditions for developing students' logical thinking skills in a digital learning environment. It highlights the methodological significance of using electronic learning resources, interactive tasks, problem situations, digital simulations, and concept maps to develop logical thinking. It also considers approaches aimed at strengthening students' abilities to analyse information, compare and classify it, identify cause-and-effect relationships, provide evidence, and draw independent conclusions. The article substantiates the importance of selecting digital tools in line with learning objectives, adapting tasks to students' individual characteristics, and assessing the thinking process.

Keywords: digital learning environment, logical thinking, didactic possibilities, digital learning resources, interactive tasks, problem-based learning, critical thinking, cause-and-effect relationships, independent conclusion, pedagogical technologies.

INTRODUCTION

In the modern education system, an important pedagogical task is not only to develop students' knowledge and skills but also to strengthen their independent thinking, ability to analyse information, solve problem situations, and substantiate conclusions with evidence. This task is particularly significant in conditions where the flow of information is accelerating and digital technologies are exerting an increasingly strong influence on everyday life and the educational process. Students need to become active participants in learning who do not merely receive information, but understand its meaning, assess its reliability, identify relationships, and draw independent conclusions.



A digital learning environment creates broad didactic opportunities for presenting educational content in different formats, increasing students' cognitive engagement, and taking individual learning needs into account. Electronic learning resources, interactive tasks, virtual models, digital simulations, and learning platforms enable students to explore different situations, compare information, test hypotheses, and seek alternative solutions. However, the use of digital tools alone does not ensure the development of logical thinking. Digital resources must be aligned with clear didactic objectives and used through methods that encourage students to analyse independently, provide reasons, and draw conclusions [1].

Logical thinking skills are demonstrated through interrelated mental operations such as analysis, comparison, classification, generalisation, identification of cause-and-effect relationships, evaluation of evidence, and drawing conclusions. These skills are important when students learn different subjects, apply their knowledge in new situations, and solve everyday problems. Therefore, their development should not be limited to separate exercises; it should be integrated consistently with subject content, problem-based tasks, and practical activities.

One important aspect of developing logical thinking in a digital learning environment is activating students' thinking processes. For example, electronic tests can require students not only to select an answer but also to explain the reasons for their choice, compare alternative options, and support a conclusion with evidence. Problem situations, concept maps, interactive tables, and digital simulations help students identify relationships between pieces of information, try different solutions, and reconsider their own ideas. The teacher's role is not to provide ready-made answers, but to guide students towards independent thinking and help them substantiate their reasoning [2].

At the same time, developing logical thinking skills in a digital learning environment requires tasks to be adapted to students' age-related characteristics, individual abilities, and levels of preparedness. Gradually increasing task complexity, providing timely feedback, and assessing student performance against clear criteria are important methodological conditions. Assessment should take into account not only the final answer but also how students analysed the problem, which evidence they used, and how they arrived at their conclusions.

The relevance of this issue stems from the need to combine the didactic potential of digital learning tools effectively with pedagogical



methods aimed at developing logical thinking. Purposeful selection of digital resources, development of a system of tasks focused on logical thinking, and systematic organisation of students' cognitive activity are important directions for improving the quality of education [3].

The aim of this article is to analyse the didactic possibilities for developing students' logical thinking skills in a digital learning environment and to substantiate methodological approaches for their effective use in the educational process. To achieve this aim, the article describes the core components of logical thinking, identifies the pedagogical potential of digital learning resources, examines tasks and methods that support thinking activity, and develops recommendations for assessing students' logical reasoning.

MAIN BODY

The didactic essence of developing logical thinking skills in a digital learning environment

Developing logical thinking skills involves not only mastering educational content but also improving students' attitudes towards information and the ways in which they organise their cognitive activity. Beyond memorising information, students should identify relationships between data, distinguish general patterns, test the validity of assumptions, and assess the logical consistency of conclusions. In this process, the issue of how knowledge is used and justified is as important as the amount of knowledge acquired.

A distinctive feature of developing logical thinking in education is that this ability is cultivated not only by solving logic problems but also through understanding the content of school subjects. For example, science requires students to identify the causes of phenomena; mathematics involves comparing solution strategies; history requires analysing links between events; and language lessons involve checking the semantic and logical coherence of a text. These activities require students to use thinking operations consciously. Thus, logical thinking should be developed continuously through subject content and learning tasks rather than being confined to a separate lesson.

The didactic value of a digital learning environment lies in its capacity to enable students to work with different forms of information, test their assumptions, and compare results. Digital technologies can therefore serve not merely as tools for presenting material electronically, but also as a



learning environment for designing cognitive activity, monitoring thinking processes, and allowing students to analyse their own outcomes [4].

Nevertheless, the presence of a digital environment does not mean that logical thinking will develop automatically. If students only click buttons, choose from ready-made options, or repeat an answer supplied by the system, sufficient conditions for independent reasoning may not be created. The didactic value of a digital task is therefore determined not by its technological novelty, but by the type of thinking it encourages, the evidence it requires students to use, and the learning outcome towards which it is directed.

Digital didactic opportunities that support the development of logical thinking

Representing information in different formats and identifying relationships between them. Presenting a concept through text, an image, a table, a diagram, or an animation helps students examine its content from several perspectives. For example, when a phenomenon is first described in text and then represented by data in a table, students can compare the two formats and identify correspondences. This process activates not only the ability to transform the external form of information but also the ability to understand its meaning and identify essential features.

Creating conditions for identifying patterns and testing hypotheses. Digital models and simulations allow students to change a particular condition and observe the resulting difference. This is especially important when studying cause-and-effect relationships. Students first propose a hypothesis, then compare the observed results with it and, if necessary, revise their ideas. From a didactic perspective, the key is not simply to observe the outcome, but to explain why it occurred.

Working with alternative solutions and counterexamples. Simple tasks often focus on finding a single correct answer. However, deeper development of logical thinking requires students to consider other solutions as well. Digital learning resources can present several solutions to the same problem, allow students to check whether each meets the given conditions, and support analysis of examples that disprove an incorrect assumption. For instance, students may be asked to find both an example that supports a rule and a counterexample that reveals the rule's limits. As a result, they learn to evaluate the validity of an idea through its logical grounds rather than superficial similarity.



Adapting learning activities and identifying difficulties in reasoning. Digital tasks can record information about students' answers, attempts, and performance processes. Such data can help teachers identify the types of tasks that cause difficulty and adapt subsequent activities to students' needs. However, data recorded by a system are not sufficient on their own to draw a definitive conclusion about a student's logical ability. They should be analysed together with students' explanations, written solutions, and teachers' observations.

Organising collaborative thinking and argumentation. In a digital environment, students can share their hypotheses in a shared document, on an electronic whiteboard, or through a discussion platform, compare ideas, and analyse solutions together. This process encourages students not only to express their own ideas but also to listen to others' arguments and evaluate them. For collaboration to contribute to logical thinking, each participant's views should be justified, and the group's final decision should be explained with evidence.

Monitoring one's own thinking and conducting reflective analysis. Through digital journals, brief written explanations, and electronic portfolios, students can compare their initial hypotheses with their final conclusions and record which evidence changed their views. This method helps students understand not only the result but also the process of thinking. Reflection thus becomes a means of consciously regulating one's own activity in addition to external assessment of logical thinking.

The relationship between digital didactic opportunities and logical skills

When selecting digital tools, what matters more than the technology's name or popularity is the type of thinking activity it helps organise. The same digital platform can support different tasks: it may be used to check basic knowledge or to analyse a complex situation and evaluate evidence. Therefore, before selecting a digital tool, teachers should identify the skill they intend students to develop.

Table 1. Didactic possibilities of a digital learning environment and their impact on logical thinking



Didactic possibility	Content of learning activity	Skill developed	Example of a task
Representing information in different formats	Comparing information presented in text, tables, and diagrams	Analysis, comparison, generalisation	Compare a text and a diagram about the same phenomenon and write an overall conclusion.
Digital modelling	Changing conditions and observing results	Formulating hypotheses; identifying cause and effect	Explain how the result changes when one factor is altered.
Testing alternative solutions	Analysing several solutions to one problem	Argumentation; critical evaluation	Compare solutions in terms of whether they meet the given conditions.
Using counterexamples	Identifying the limits of a rule or claim	Logical verification; generalisation	Find a situation in which the stated rule does not apply and explain why.
Adapted tasks	Completing tasks with different levels of complexity	Independent thinking; selecting a strategy	Solve the same problem under simpler and more complex conditions.
Digital collaboration	Sharing ideas and discussing evidence	Logical coherence; argumentation; comparing viewpoints	Develop the group's overall conclusion on the basis of evidence.
Reflective records	Comparing an initial idea with a final conclusion	Analysing one's thinking; identifying errors	Explain how the decision changed and which evidence prompted the change.

Source: Compiled by the author on the basis of a theoretical and methodological analysis of the topic.



As the table shows, the didactic possibilities of digital learning are not limited to presenting information or checking results quickly. They can support the organisation of students' thinking at different levels. At the same time, achieving the expected outcomes depends on the content of the task, the instructions given to students, and the quality of the analysis organised by the teacher.

Didactic requirements for designing digital tasks

The first requirement is that a task should have a clear cognitive objective. For example, if the objective is to identify cause-and-effect relationships, the task should require students not merely to select an answer but to distinguish the cause from the outcome and explain the relationship between them.

The second requirement is that the task should enable students to understand the problem and justify their solution. Awarding marks only for the final answer limits the assessment of the thinking process. It is therefore advisable for digital tasks to provide space for a brief written explanation, the steps used to reach a solution, or the reasons for selecting a particular option.

The third requirement is to provide sufficient scope for independent thinking. If a digital system supplies ready-made instructions or answers at every step, students may have less need to solve the problem themselves. Support and prompts should therefore be provided when students encounter difficulties, without completing the entire solution on their behalf.

The fourth requirement is alignment with students' age-related characteristics and the subject content. The same type of digital exercise will not be equally effective for all grades and subjects. Younger students may benefit from visual comparison, sequencing, and simple classification tasks; in higher grades, more complex tasks may be needed, such as analysing contradictory evidence, considering several conditions, and checking whether a conclusion is justified.

The fifth requirement is meaningful feedback. Students should not only be shown an error but also be given an opportunity to analyse it again and improve their solution. For example, after the system marks an answer as incorrect, students might be asked to identify which condition they overlooked or to try another solution. Feedback then becomes a didactic mechanism that supports continued learning rather than serving only as a control tool.



The sixth requirement is the reasonable use of digital task results in pedagogical decision-making. Automated assessment provides teachers with initial information about students' performance, but it cannot fully reveal their thinking processes. It is therefore important to supplement automated results with oral explanations, written solutions, group discussions, and teacher observations.

Opportunities for developing logical thinking across subjects
An important direction in developing logical thinking is to connect digital tasks with different school subjects. Although logical thinking appears in different ways depending on subject content, it is underpinned by general mental operations such as analysing information, identifying relationships, and drawing evidence-based conclusions.

In mathematics, digital environments can be used to solve the same problem in different ways, compare solution strategies, and check whether a result meets the given conditions. The main focus in such tasks should not be limited to obtaining the correct answer; it should also include the logical consistency of the method used. Students compare their solution with another approach and explain which conditions guided their choice of method.

In science subjects, digital models, graphs, and observational data can be used to analyse relationships between phenomena. Students first formulate a hypothesis, examine the observation results, and compare them with their initial ideas. Particular attention is paid to distinguishing evidence from assumptions, drawing conclusions based on observations, and recognising the limits of a conclusion.

In history and social studies, digital sources, timelines, and comparative diagrams can be used to study the sequence of events, their causes, and their consequences. Students can compare information from different sources and identify where it agrees or differs. Such activities support a critical attitude towards information and the formation of evidence-based historical conclusions.

In language and literature lessons, students can be given tasks that analyse the coherence of ideas in a text, the relationship between evidence and conclusions, the author's position, and the internal structure of the text. Students identify the main idea, distinguish the evidence supporting it, and assess how well the conclusion corresponds to the text's content.

The advantage of interdisciplinary use is that students come to understand logical thinking operations not as techniques belonging to a



single subject, but as general cognitive tools that can be used in different situations. To achieve this, teachers should adapt task content to the objectives of their subject while consistently maintaining shared expectations for analysis, argumentation, and drawing conclusions.

New approaches to assessing logical thinking skills

In a digital learning environment, relying only on the proportion of correct answers provides a limited picture of students' thinking activity. Assessment should therefore also consider how students use information, identify relationships between ideas, provide evidence, and justify their conclusions. The following criteria may be considered:

Information analysis — the student's ability to distinguish important from secondary information in a task, interpret the conditions correctly, and identify the essence of the problem.

Identification of relationships — the ability to explain cause-and-effect links, identify similarities and differences, and substantiate relationships between phenomena.

Strength of evidence — the ability to support an idea with relevant information, compare alternative solutions, and explain the reasons for the selected conclusion.

Logical consistency of the conclusion — whether the conclusion follows from the initial conditions and whether the reasoning avoids unsupported transitions or contradictions.

Ability to reconsider one's own ideas — the ability to re-examine an initial view when new evidence emerges, identify an error, and improve the conclusion if necessary.

These criteria can be developed in the form of a rubric or an analytical assessment sheet. Such tools help teachers identify which skills a student has developed and where additional pedagogical support is needed. In addition, reviewing automated assessment results alongside students' written explanations, oral presentations, or practical solutions can improve the reliability of assessment.

Another important issue in digital assessment is the pedagogical interpretation of data. A low score on a platform does not always indicate weak logical thinking; it may also result from misunderstanding the question, technical difficulties, language-related factors, or a task format that is unsuitable for the student. Results should therefore be analysed in a broader context, more than one assessment method should be used, and conclusions about a student should not be based on a single indicator.



Overall, the didactic possibilities for developing logical thinking skills in a digital learning environment are associated with representing information in different formats, identifying patterns, testing alternative solutions, supporting collaborative argumentation, and encouraging reflection. The pedagogical value of these possibilities depends not on the number of digital tools available, but on how meaningfully students' thinking activity is organised. Therefore, improving digital education should focus not simply on using technology, but on the thinking skills developed through it.

CONCLUSION

The analysis of didactic possibilities for developing logical thinking skills in a digital learning environment demonstrates the importance of using digital technologies purposefully and on a sound pedagogical basis. Digital tools create favourable conditions for representing learning materials in different formats, identifying relationships among information, testing hypotheses, and comparing alternative solutions. However, the educational value of these possibilities depends not on the technology itself, but on how students' thinking activity is organised. Theoretical analysis suggests that visual representation of information, digital modelling, analysis of counterexamples, adapted tasks, collaborative thinking, and reflective activity are important didactic opportunities for developing logical thinking. These opportunities can help develop students' abilities to analyse, compare, generalise, identify cause-and-effect relationships, provide arguments, and draw independent conclusions.

Digital tasks should also be designed around clear cognitive objectives, aligned with students' age-related and individual characteristics, allow independent thinking, and provide meaningful feedback. Rather than directing students only towards finding the correct answer, tasks should encourage them to explain the reasons for their answers, evaluate evidence, and test alternative conclusions. This can contribute to more meaningful development of logical thinking.

Developing logical thinking skills across different subjects is another important methodological direction. In mathematics, science, history, and language lessons, digital tools can be used to organise tasks that require analysis, identification of patterns, and evidence-based conclusions. This approach can help students apply logical thinking beyond isolated exercises and use it in a variety of educational and real-life situations. Assessment of logical thinking should take into account not only the final answer but also the student's reasoning process, use of evidence, logical consistency of



conclusions, and ability to reconsider an idea. Analysing results from digital platforms together with written explanations, practical solutions, and teacher observations can help identify students' learning needs more accurately.

In general, the didactic possibilities for developing logical thinking skills in a digital learning environment emerge from the alignment of educational content, digital resources, learning tasks, and assessment criteria. In the future, pedagogical experiments across different grades and subjects should be conducted to establish the practical effectiveness of these approaches, compare students' initial and final indicators, and analyse the results scientifically. This would make it possible to refine digital learning resources and develop more precise methodological recommendations for fostering students' logical thinking skills.

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