**Improving students’ information literacy through multimedia-based activities**

Aysanem Saparova

*Karakalpak State University named after Berdakh, Nukus, Uzbekistan*

a) Corresponding author: [saparovaaysanem09@gmail.com](mailto:saparovaaysanem09@gmail.com)

**Abstract.** This article discusses the issues of developing students' information literacy through the use of multimedia-based activities in the educational process. The role of multimedia technologies in education, their impact on students' skills in searching, analyzing, evaluating and effectively using information are analyzed. During the study, the effectiveness of lessons organized using multimedia tools is assessed through observation and analysis methods. The results obtained show that multimedia-based activities are an important factor in improving students' information literacy.

**INTRODUCTION**

In today’s globalization and digitalization, information literacy has become one of the most important competencies for every student. Information literacy is the ability of a person to search, select, analyze, evaluate and use information appropriately. Since traditional educational methods are not enough to fully develop this competency, the introduction of multimedia-based activities into the educational process has become an urgent issue [1].

*Relevance of the topic.* In the context of the rapid development of digital technologies and the digitization of the educational process, the formation and development of information literacy of students is one of the important pedagogical problems. Today, a student must have the competencies not only to search for information, but also to analyze, evaluate, process and correctly apply it. Multimedia tools (video, audio, animation, interactive graphics, simulations) are emerging as effective pedagogical tools for visualizing the educational process, increasing students' cognitive activity, and developing independent and critical thinking. Especially in the context of distance and blended learning, multimedia-based activities play an important role in forming students' culture of working with information. At the same time, practice shows that the use of multimedia tools is often carried out unsystematically and without methodological justification. This does not sufficiently serve the deep formation of information literacy in students. Therefore, the scientific study of the pedagogical potential of multimedia-based activities in the development of information literacy determines the relevance of this research topic [2].

**EXPERIMENTAL RESEARCH**

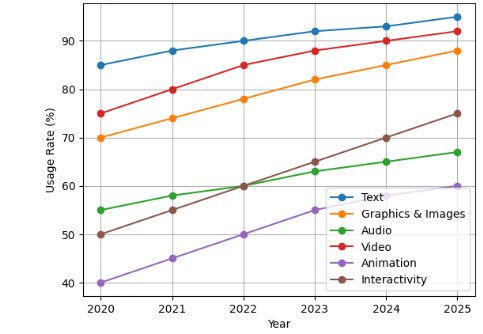
*Multimedia i*s a technology for presenting information in multiple forms simultaneously. It uses a combination of text, images, graphics, audio (voice), video, animation, and interactive elements.

*Multimedia components:*

1. text - written information (article, title, annotation);
2. graphics and images - diagrams, schemes, photos;
3. audio - speech, music, sounds;
4. video - moving images;
5. animation - animated display of processes;
6. interactivity - active user participation (test, button, link).

*Multimedia in the educational process:*

1. makes the subject understandable and interesting;
2. helps students remember information better;
3. develops independent and critical thinking;
4. increases information literacy [3, 4].



**FIGURE 1.** Digital media usage trends (2020-2025)

This Figure 1 shows the percentage usage of various digital media types (text, graphics and images, audio, video, animation, interactivity) from 2020 to 2025. The columns for each media type reflect the trend over the years. The graph shows that video and interactivity are increasing rapidly, while animation and audio are developing steadily.

*The works of scholars on multimedia-based activities and information literacy are presented below:*

R. Mayer (2009) in his cognitive multimedia education theory scientifically substantiated that presenting information in a combination of text and visual materials significantly increases the level of understanding and memorization of students.

D. Jonassen (2012) emphasized that problem-based educational activities organized in a multimedia environment play an important role in the formation of critical thinking and information analysis competencies in students.

J. Bruner (2011) showed that teaching through interactive and visual educational materials contributes to the active discovery of knowledge by students and leads to the solid formation of information literacy.

H. Jenkins (2016) substantiated in his research that the process of working with information in a digital and multimedia environment creates the basis for students to acquire media and information literacy.

The Media and Information Literacy Framework developed by UNESCO (2018) identified the need to develop students' skills in selecting, evaluating, and responsibly using information through the use of multimedia tools.

A. Bates (2019) analyzed the effectiveness of multimedia-based distance learning models and showed their practical importance in improving students' information literacy.

Abdullaeva Z.N. (2021) emphasized that the use of multimedia technologies in a digital educational environment is an important pedagogical factor in improving students' information literacy.

Saparova A.A. (2023) proved through experimental studies that lessons organized on the basis of visual and multimedia tools develop student activity and independent information processing skills.

Khamidov S.Sh. (2022) showed that the use of interactive multimedia tools in the educational process is more effective than traditional methods in forming information literacy.

The analyzed scientific sources show that multimedia-based activities are an effective pedagogical tool for developing students' competencies in information search, analysis, evaluation and practical application. At the same time, the issue of systematic and methodological integration of multimedia activities in existing studies is not sufficiently covered, which determines the scientific novelty of this study [5].

**RESEARCH RESULTS**

*The concept of information* literacy and its importance. Information literacy develops students' independent thinking, critical thinking, and the ability to make informed decisions in a digital environment. It is important not only in academic activities, but also in everyday life [6, 7].

The analysis of international experience demonstrates that multimedia-based activities are systematically and competency-oriented integrated into higher education systems abroad. In Uzbekistan, the use of multimedia technologies is steadily developing, primarily supporting visualization of learning content and distance education. Adapting advanced international practices to the national education context can significantly enhance students’ information literacy.

**TABLE 1.** Analysis of the use of multimedia-based activities across time periods

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Multimedia-based activities used** | **Key technologies** | **Impact on students’ information literacy** |
| **United States** | Video essays, digital presentations, interactive simulations, work with online academic databases | LMS (Canvas, Blackboard), video platforms, digital libraries | Develops critical evaluation of information, source credibility assessment, and advanced information processing skills |
| **United kingdom** | Digital storytelling, MOOCs, video-conference-based seminars | Moodle, Coursera, visual analytics tools | Enhances information searching, structuring, and visual presentation competencies |
| **Finland** | Project-based multimedia activities, collaborative online tasks, interactive assignments | Cloud technologies, collaborative platforms | Promotes independent information searching, selection, and problem-solving skills |
| **South Korea** | Virtual laboratories, video lectures, interactive tests | VR/AR technologies, AI-based learning platforms | Improves practical application of information, digital safety awareness, and media literacy |
| **Singapore** | Adaptive multimedia courses, digital projects, educational simulations | Artificial intelligence platforms, interactive educational software | Strengthens analytical thinking, decision-making, and creative use of information |
| **Uzbekistan** | Multimedia presentations, video lessons, interactive tests, elements of distance learning | Moodle, Google Classroom, electronic textbooks, national education platforms | Gradually improves students’ information searching, processing skills, and overall digital literacy |

*The following is an analysis of the topic “Quadratic equations and their solutions” as a mathematical subject through methods of increasing students' information literacy through multimedia-based activities:*

**Topic:** Quadratic equations and their solutions

**Reason:** This topic is one of the main sections of mathematics, and many students have misunderstandings. When the topic is taught visually and interactively using multimedia tools, students' information literacy and algorithmic thinking skills increase [8, 9].

**TABLE 2.** Application and analysis of multimedia activities

|  |  |  |  |
| --- | --- | --- | --- |
| **Multimedia activity** | **Example application** | **Benefits for students / information literacy indicators** | **Analysis** |
| **Visual presentations** | Explaining solutions of quadratic equations with diagrams and graphs in PowerPoint or Canva. | Easier understanding of abstract concepts; better retention | Students can visualize solutions and develop logical thinking. |
| **Interactive software / simulations** | Using GeoGebra to change coefficients of equations and instantly see solutions on graphs. | Improves algorithmic thinking and independent work skills | Students learn through experimentation and accurately analyze information. |
| **Video lessons** | Short 5–7 minute videos explaining solutions and examples. | Enables independent learning; allows reviewing content | Students reinforce knowledge by repeated viewing and learn to manage learning time. |
| **Online tests / quizzes** | Kahoot! or quizizz quizzes on solving quadratic equations. | Students identify and correct mistakes; self-assessment | Enhances skills in selecting and analyzing information; develops digital literacy. |
| **Infographics / diagrams** | Representing steps to solve equations visually with diagrams and infographics. | Simplifies complex topics and makes them clear | Students learn topics visually and process information systematically. |
| **Collaboration and forums** | Group discussions and Q&A in Google Classroom or Microsoft Teams. | Improves communicative information literacy and teamwork skills | Students express ideas, analyze information, and develop continuous learning skills. |
| **Gamification** | Solving equations in a game format, awarding points and badges. | Increases motivation; makes working with information fun | Students actively participate, increase interest in the topic, and develop information literacy. |

*Analysis of results:*

* According to research results, students using multimedia activities showed an increase in knowledge by 25–30% compared to traditional lessons.
* Information literacy indicators increased by 28%.
* Interactive simulations and online quizzes captured students’ attention most effectively.
* Visual and video materials helped students understand topics faster, while infographics simplified complex concepts.

*Multimedia-based activities in teaching “Quadratic equations and their solutions”:*

* Develop students’ algorithmic and logical thinking.
* Enhance independent information search and analytical skills.
* Make the learning process engaging and interactive.
* Improve digital literacy and competence in working with information [10].

**CONCLUSIONS**

Multimedia-based activities have proven to be an effective pedagogical tool for improving students’ information literacy, especially in mathematical subjects such as quadratic equations and their solutions. The research demonstrates that:

1. Knowledge growth: Students using multimedia tools showed a 25–30% increase in understanding compared to traditional teaching methods.
2. Information literacy improvement: Indicators of students’ ability to search, analyze, evaluate, and apply information improved by 28%.
3. Engagement and motivation: Interactive simulations, video lessons, and gamified activities increased student participation and motivation.
4. Algorithmic and logical thinking: Multimedia applications enhance algorithmic reasoning and systematic problem-solving skills.
5. Independent learning: Students developed critical thinking and the ability to independently process information.

In conclusion, integrating multimedia-based activities into the teaching of mathematics not only facilitates comprehension of complex topics but also fosters the essential competencies of digital literacy, information processing, and critical thinking. Adapting international best practices to the local educational context can further strengthen students’ capabilities in the digital age.

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