

# Advantages of The Cluster Approach Over Traditional Approaches in Developing Students' Digital Competence

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**Abstract:** This article scientifically analyzes the pedagogical possibilities of the cluster approach in the process of developing students' digital competence and its advantages over traditional teaching approaches. In the modern education system, digital transformation processes make the development of students' skills in the effective use of information and communication technologies one of the important tasks. Therefore, the study considered the process of forming digital competence as a systematic, integrative and collaborative educational model. It was argued that the educational environment organized on the basis of the cluster approach serves the comprehensive development of students' competencies such as information literacy, use of digital technologies, communication, problem solving and independent learning activities. The research used pedagogical observation, questionnaires, experimental studies and statistical analysis methods. The results obtained showed that the educational process organized on the basis of the cluster approach is more effective in developing students' digital competence than traditional teaching methods.

**Keywords:** Digital competence, cluster approach, traditional education, higher education, digital technologies, competency-based approach.

**Introduction:** The rapid development of information and communication technologies (ICT) in modern society is driving profound changes in the content, structure, and methodology of education systems worldwide. Digital transformation processes are affecting not only economic sectors and production activities but also higher education institutions, imposing new and complex challenges on them. Among these challenges, one of the most pressing tasks for higher education institutions is the preparation of a new generation of specialists who are capable of functioning effectively in a highly digitalized and interconnected world. These specialists are expected not only to possess advanced professional knowledge and technical skills in their respective fields but also to demonstrate well-developed digital competencies. This includes the ability to navigate and critically evaluate information, utilize digital tools to solve complex problems, engage in collaborative work in digital environments, and communicate effectively through various digital channels. Furthermore, the cultivation of

a culture of responsible and ethical use of digital resources, awareness of digital security, and adaptability to rapidly evolving technological environments are essential components of modern higher education. In this context, the development of students' digital competencies has become a core objective of contemporary higher education, as it ensures that graduates are not only professionally proficient but also digitally literate, innovative, and capable of contributing meaningfully to society and the economy in an era defined by technological advancement and digital transformation.

Digital competence is understood as a complex and multifaceted skill set that encompasses an individual's ability to effectively search, evaluate, and process information, solve problems using digital technologies, and communicate and collaborate within digital environments (Vuorikari et al., 2022; Redecker, 2017). This competence also implies a capacity for critical thinking, creativity, and responsible use of digital resources, which are essential in today's knowledge-

based society. In this context, the development of students' digital competence has emerged as a key priority of modern higher education. It not only supports students in achieving academic success but also equips them with the skills necessary to thrive in a rapidly evolving digital economy. Consequently, fostering digital competence has become a central component of digital transformation strategies adopted by higher education institutions, aiming to produce specialists who are both professionally proficient and digitally literate.

Practice shows that traditional teaching methods are often focused on the transfer of knowledge and do not sufficiently develop students' independent thinking, creative approach, and skills for active work in a digital environment (Selwyn, 2016; Bond et al., 2020). Therefore, the cluster approach is emerging as an effective tool in modern pedagogical practice. The cluster approach allows for increased interaction in the educational process, integration of knowledge, and systematic development of competencies, as well as fully utilizing the functional capabilities of the electronic learning environment (Zakharova, 2019).

The main purpose of this study is to scientifically analyze the advantages of the cluster approach over traditional teaching approaches in developing students' digital competence, determine its pedagogical effectiveness, and develop practical recommendations. At the same time, the educational model organized in the article based on a cluster approach allows for the formation of individual learning trajectories of students, increased interactivity between teacher and student, and comprehensive development of digital competencies.

## **METHODS**

The research methodology was developed by integrating systemic, competency-based, and cluster approaches, which together provided a framework for the comprehensive development of students' digital competence and enabled the organization of the educational process in an integrated and coherent manner (Vuorikari et al., 2022; Redecker, 2017). This combined methodological approach ensured that all dimensions of digital competence—ranging from information literacy to problem-solving and digital communication—were addressed in a coordinated way.

To assess the effectiveness of the cluster approach in fostering students' digital competence, a range of scientific research methods was employed. Initially, an analysis of scientific and pedagogical literature was conducted, focusing on existing theoretical studies on digital competence, the cluster approach, and

traditional teaching methods. In addition, international frameworks and standards, including DigComp and DigCompEdu, were examined to provide a global benchmark for digital competence development. This analysis allowed the researchers to identify the pedagogical principles underlying the cluster approach and to substantiate its effectiveness in enhancing the educational process.

Also, comparison and generalization methods were used to compare the pedagogical effectiveness of cluster and traditional teaching approaches, which served to formulate methodological recommendations. In the development of the practical part of the study, a cluster educational model was developed using the pedagogical modeling method to develop students' digital competence. Questionnaires and diagnostic tests were used to determine the initial and final levels of students' competence. At the same time, experimental work created the opportunity to practically observe the effectiveness of developing students' digital competences using cluster software. Statistical analysis methods were used to scientifically substantiate the results obtained and compare the levels of digital competence by groups. This methodological approach ensured the reliability of the study and clearly demonstrated the pedagogical effectiveness of the cluster approach. Students studying in the information technology department of a higher educational institution participated in the study, and they were divided into two groups: the experimental group and the control group.

In the control group, the educational process was organized according to traditional teaching methods. Students engaged with the educational materials through conventional approaches, completed independent assignments, and participated in the core pedagogical activities following standard instructional practices. This approach primarily emphasized the transmission of knowledge from instructor to student, with limited opportunities for individualized learning, collaborative problem-solving, or the integration of digital tools into the learning process. In the experimental group, an educational model developed based on a cluster approach was introduced. This model allowed organizing the educational process through digital technologies, collaborative activities and problem-solving tasks. As a result, students had the opportunity to develop skills in interactive work, independent analysis and practical application of digital competencies.

The level of students' digital competence in the study was evaluated using a set of comprehensive and multidimensional criteria. These assessment criteria encompassed information literacy, proficiency in using

digital technologies, digital communication and teamwork skills, problem-solving and creative thinking competencies, as well as a culture of digital security. By employing this holistic framework, the study was able to assess students' digital competencies in an integrative and systematic manner, capturing not only technical skills but also higher-order cognitive abilities, collaborative capacities, and responsible digital behavior.

This approach ensured that the evaluation reflected the complex and interconnected nature of digital competence, highlighting both strengths and areas for further development. It also allowed for a comparative analysis between experimental and control groups, providing a reliable basis for measuring the effectiveness of the cluster-based educational approach in enhancing digital competence. The results obtained were compared between the experimental and control groups. Statistical analysis revealed that the experimental group showed significantly higher results in all criteria in the educational process organized on the basis of a cluster approach. At the same time, the cluster method significantly developed the students' abilities to form an individual learning trajectory, independently solve problematic tasks, and effectively communicate in a digital environment. The cluster approach is a more effective pedagogical tool than traditional teaching methods in developing digital competence, and serves to optimize the educational process and fully utilize the capabilities of the electronic learning environment.

## RESULTS

The results of the pilot study indicated that an educational process organized on the basis of a cluster approach had a significant positive impact on the development of students' digital competence. Students in the experimental group demonstrated marked improvements across all assessed dimensions, including information literacy, digital technology proficiency, teamwork and communication skills, problem-solving, creative thinking, and digital security awareness. To validate these findings, statistical analyses were conducted to compare the performance of the experimental group with that of the control group, which followed traditional teaching methods. The results revealed statistically significant differences, confirming the effectiveness of the cluster-based approach in enhancing students' digital competencies. These outcomes provide strong empirical support for the pedagogical advantages of integrating cluster-based methodologies into higher education, highlighting their potential to foster comprehensive and systematic digital competence development.

The following positive changes were observed in the experimental group as a result of the cluster-based educational approach:

**Information literacy and analytical skills:** Students actively developed their abilities to search, analyze, and process information. The average score for these skills in the experimental group increased by 28%, compared to only a 7% increase observed in the control group, indicating a substantial improvement attributable to the cluster-based methodology.

**Problem-solving with digital technologies:** The ability to address complex problems using digital tools improved significantly. Students acquired practical skills in designing and implementing digital solutions through both independent and collaborative projects, enhancing their applied competencies.

**Digital communication and teamwork culture:** The experimental group demonstrated a notable increase in the effectiveness of communication and collaboration on electronic platforms. Statistical analysis confirmed a significant improvement in participants' ability to work collectively and engage in team-based digital interactions.

**Motivation and self-directed learning:** Students' motivation for independent learning and their self-management skills were strengthened, contributing to greater engagement and ownership of the educational process. These results collectively indicate that the cluster-based approach effectively supports the integrative development of digital competencies, surpassing the outcomes achieved through traditional teaching methods.

The statistical analysis revealed that the experimental group significantly outperformed the control group across both high- and medium-level indicators in all components of digital competence. These differences were statistically significant ( $t = 4.23$ ;  $p < 0.01$ ), providing robust empirical evidence for the pedagogical effectiveness of the cluster-based approach.

The findings demonstrate that the cluster approach facilitates the comprehensive development of students, encompassing not only technical skills, but also digital communication, problem-solving, and self-directed learning competencies. This integrative development lays the foundation for individualized learning trajectories, allowing each student to progress according to their capabilities and learning needs. Furthermore, the approach enhances the effective utilization of e-learning environments, promoting active engagement, collaborative interaction, and the practical application of digital knowledge within modern higher education contexts.

## DISCUSSION

The results of the study indicate that the cluster approach offers a number of significant advantages over traditional teaching methods in fostering students' digital competence. First and foremost, the cluster approach enables the organization of the learning process as a collaborative and interactive activity, rather than a simple transmission of knowledge. This collaborative framework allows students to develop social and communicative competencies, strengthen teamwork skills, and communicate effectively using digital platforms. By engaging in joint problem-solving tasks and collaborative projects, students are able to experience practical applications of their learning while enhancing their ability to work in virtual and hybrid learning environments.

The cluster-based integration methodology allows for the systematic and consistent integration of technological tools in the process of developing digital competence. The educational process includes several stages. First, through diagnostics of students, their existing level of digital competence is determined, and based on these results, the main cluster or set of clusters that need to be developed is determined. After that, a personalized adaptive educational trajectory is developed for each student. In this process, with the help of artificial intelligence (AI)-based adaptive educational systems, the student is provided with technological tools and content that are relevant only to the selected cluster, for example, the Information and Media Cluster. (Taylakova 2025)

Media and information literacy plays an important role in the modern educational process, as it forms the basis for students' ability to search, analyze, evaluate, and effectively use information. In the digital learning environment, the development of these skills contributes to students' critical thinking and their ability to work with various digital information sources (Djumaboyevna, 2024).

In addition, the cluster-based methodology promotes interactive communication among students, increasing engagement and participation. This interaction not only reinforces the learning material but also encourages the development of critical thinking, creative problem-solving, and self-directed learning skills (Bond et al., 2020). Compared to traditional approaches, where instruction is largely teacher-centered and knowledge is delivered in isolation, the cluster approach integrates content and skills in a holistic and systemic manner, fostering an environment in which competencies are developed simultaneously and in relation to each other.

Moreover, the cluster approach supports the individualization of the learning process, allowing each student to progress at their own pace and according to their own strengths and weaknesses. When combined with digital tools, online collaboration platforms, and adaptive resources, the cluster methodology enhances the overall effectiveness of e-learning environments and contributes to preparing students for real-world challenges in digital and professional contexts.

In summary, the findings confirm that the cluster approach not only improves technical skills, but also cultivates digital communication, teamwork, problem-solving, and independent learning competencies, making it a highly effective pedagogical strategy for modern higher education.

Secondly, the cluster approach facilitates the integration of learning materials across different disciplines. In traditional teaching methods, knowledge is often compartmentalized within separate subject areas, which can limit the holistic development of competencies. By contrast, the cluster model presents knowledge and skills in an interconnected and coherent manner, enabling students to master conceptual frameworks systematically and comprehensively (Redecker, 2017). This integration supports a deeper understanding of subject matter and encourages students to see the relationships between different knowledge domains, fostering critical thinking and applied problem-solving skills.

Thirdly, the cluster approach enables the individualization of student learning activities. Each student has the opportunity to design an educational trajectory aligned with their abilities, learning needs, and personal goals. Such individualization enhances motivation, encourages active participation, and strengthens self-directed learning, thereby promoting greater autonomy in the learning process. Moreover, the effectiveness of the educational process is further amplified when the cluster approach is implemented in conjunction with digital technologies. The capabilities of modern e-learning environments—including interactive tests, problem-based tasks, virtual laboratories, and online collaboration tools—provide practical avenues for students to develop and apply their digital competencies. This combination not only enhances pedagogical outcomes but also contributes to the technological modernization of the educational environment (Vuorikari et al., 2022).

The findings of the study indicate that the cluster approach serves as an effective tool for the comprehensive development of digital competence, creating an integrative, interactive, and individualized educational model. Compared to traditional teaching

methods, it offers significant pedagogical advantages, promoting both conceptual mastery and practical skill development while preparing students for the demands of a digitalized and collaborative professional landscape.

## **CONCLUSION**

In conclusion, the results of the study demonstrate that the cluster approach is a significantly more effective pedagogical strategy for developing students' digital competence compared to traditional teaching methods. The cluster model facilitates the comprehensive and integrative development of students' competencies, including information literacy, proficiency in digital technologies, digital communication, and problem-solving and creative thinking skills. By addressing these competencies simultaneously, the cluster approach ensures that students acquire both technical and higher-order cognitive skills essential for academic and professional success.

Moreover, the cluster approach supports the effective organization of a modern digital learning environment. It achieves this by integrating the learning process, enhancing collaboration and teamwork, and enabling the individualization of learning trajectories for each student. The implementation of interactive resources and e-learning platforms within this approach further enhances the quality and efficiency of the educational process, providing students with opportunities for active engagement, self-directed learning, and practical application of digital skills.

Looking forward, it is recommended to expand the pedagogical and technological potential of the cluster approach by integrating it with artificial intelligence technologies, adaptive learning systems, and advanced digital learning platforms. Such integration will further strengthen the development of students' digital competencies, optimize personalized learning pathways, and contribute to the preparation of highly skilled, competitive specialists who are capable of thriving in a dynamic digital economy. Overall, the findings underscore the pedagogical and technological advantages of the cluster-based educational model, highlighting its potential as a key strategy for modernizing higher education and promoting 21st-century digital competencies.

## **REFERENCES**

1. Redecker, C., & Punie, Y. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union. <https://ec.europa.eu/jrc/en/digcompedu>
2. Kallas, K., & Pedaste, M. (2022). How to Improve the Digital Competence for E-Learning? Applied Sciences, 12(13), 6582., <https://doi.org/10.3390/app12136582>
3. Porter, M. E. (1998). Clusters and the New Economics of Competition. Harvard Business Review., <https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition>
4. UNESCO (2018). A Global Framework of Reference on Digital Literacy and Skills. <https://unesdoc.unesco.org/ark:/48223/pf0000265670>
5. Pedaste, M., Kalmus, V., & Vainonen, K. (2021). Dimensions of digital competence and its assessment in basic school. Estonian Journal of Education, 9(2), 212–243.
6. Djumaboyevna, S. F. (2024). MEDIA AND INFORMATION LITERACY IN THE EDUCATIONAL PROCESS AS THE BASIS OF THE NEED FOR INFORMATION. Eurasian Journal of Academic Research, 4(7S), 622-625.
7. Taylakova, G. B. (2025). Talabalar raqamli kompetentligini klaster asosida rivojlantirishda texnologik vositalar va platformalarning roli. Строительство и образование, (3), 153-157.