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GAMIFICATION, ARTIFICIAL INTELLIGENCE AND BIG DATA IN THE FORMATION OF RESEARCH COMPETENCE OF STUDENTS

Modern higher education is undergoing rapid digitalisation, which requires updated approaches to the training of students, in particular in the area of research competence. In the context of the transition to the knowledge economy and information society, the ability of students to independently generate new knowledge, think critically, analyse large amounts of information and apply innovative technologies in the process of scientific research is becoming a priority. In this context, gamification, artificial intelligence and Big Data technologies are gaining particular importance as effective tools for enhancing cognitive activity and developing research skills.

Gamification of the educational process allows to increase students' motivation for scientific activities, engage them in solving real problems in the format of educational games, simulations, case studies, etc. Artificial intelligence opens up opportunities for personalised learning, adaptation of tasks to the individual level of development of the student, analysis of behaviour and progress in learning. The use of Big Data provides access to large amounts of scientific information, allows you to work with real data, develop analytical thinking skills, and conduct predictive research.

The relevance of the topic is due to the need to rethink traditional teaching methods in the context of the digital educational environment and the transition to interdisciplinary, technology-oriented models of research competence development. The use of digital tools and technologies not only expands educational opportunities, but also contributes to the training of specialists capable of working effectively in conditions of uncertainty, high information loads and dynamic changes.

In the context of the modernisation of higher education and the introduction of a competence-based approach, the issue of developing the research competence of higher education students is of particular relevance. The modern digital environment opens up new opportunities for organising students' research activities, providing access to information resources, analysis tools, data visualisation and collaboration.

Research competence is seen as an integrative ability of an individual to independently conduct scientific research, formulate problems, substantiate

hypotheses, apply research methods, interpret results and present them in various forms. Its main components include: motivational (interest in scientific activity, awareness of its value); cognitive (knowledge of research methodology); procedural and activity (mastery of methods of data collection, processing and analysis); reflective and evaluative (ability to think critically and self-assess performance).

Digital tools significantly expand the possibilities for organising students' research activities. These include: cloud services (Google Drive, OneDrive) for collaborative work on projects; online survey platforms (Google Forms, SurveyMonkey) for collecting empirical data; statistical data processing software (SPSS, Excel, Jamovi); digital libraries and databases (Google Scholar, Scopus, Web of Science); research visualisation tools (Canva, Power BI, Tableau). The formation of research competence of higher education students is an important condition for the development of their independence, critical thinking, and ability to innovate. The digital educational environment is an effective means of organising students' research activity. With pedagogical support, proper information and technological support, it is possible to achieve a high level of research competence.

Modern educational processes in the context of digital transformation require new approaches to learning that can increase the motivation of students and effectively develop key competencies, including research. One of these innovative technologies is gamification - the use of game mechanics in non-game contexts to engage, stimulate active participation and achieve educational outcomes.

Gamification is the use of game elements (points, levels, missions, competitions, rewards) to increase engagement and motivation in non-game processes, including education. The principles of gamification include: motivation (external and internal incentives), competition (elements of competition), defined goals and rules, real-time feedback, continuity and leveled complexity of tasks. The use of gamification in the context of research skills development allows: activating cognitive activity; ensuring gradual mastery of research methods; developing independent work skills; stimulating creative thinking.

Gamification is an effective means of developing research competence in higher education students. The combination of learning with game mechanics allows creating a motivationally rich environment that promotes active research, creativity and a responsible attitude to scientific research. Further research should be aimed at evaluating the effectiveness of individual game models in the formation of various components of competence.

Modern higher education is being transformed by digital innovations. Artificial intelligence and Big Data analytics technologies open up new opportunities to support students' research activities and develop research

competence. Given the rapid growth of information, it is important to teach students how to work effectively with data sets, identify patterns, build hypotheses and substantiate them with the use of intelligent digital tools.

Artificial intelligence technologies help to automate the collection, sorting and analysis of scientific information; formulate analytical reports based on Big Data; generate hypotheses and build predictive models; create visualisations of results; and personalise learning and feedback. Application in higher education: ChatGPT, Gemini, Claude – assistance in searching, analysing, and formulating scientific ideas; Scite.ai, Semantic Scholar – intelligent search for scientific sources; Zotero+ AI – building bibliographies with content recognition; Grammarly, Quillbot AI – improving scientific texts; Miro+ AI / Notion AI – creating mind maps and conceptual models.

Big Data gives students the opportunity to work with real arrays of social, economic, educational, biomedical data. This ensures: the development of information and statistical literacy; understanding of patterns in large samples; modelling system behaviour and forecasting results; preparation for modern labour market requirements. Educational resources on Big Data: Google Cloud BigQuery, Kaggle, Open Data Ukraine – sources of open data; Jupyter Notebook, Python (pandas, matplotlib, seaborn) – analytical environment for students of technical and humanitarian specialties; Tableau, Power BI – tools for visualising research results.

The use of artificial intelligence and Big Data in the educational process significantly expands the possibilities for developing the research competence of higher education students. These technologies contribute to the development of analytical thinking, a deeper understanding of research methods and increased academic autonomy of students. However, the effective implementation of such approaches requires methodological training of teachers, ethical regulation, and the development of a critical attitude towards artificial intelligence tools.

Thus, the combination of digital technologies and innovative teaching methods is a strategic direction of higher education development and ensuring the quality training of future researchers. In the modern educational environment, the formation of research competence of higher education students requires the introduction of innovative technologies that activate students' thinking, motivation and independent activity.

The analysis of the experience of introducing gamification, artificial intelligence and Big Data technologies into the educational process allows us to draw a number of important conclusions: gamification is a powerful motivational tool that stimulates students' active participation in research processes, promotes interest in scientific research, development of teamwork skills, strategic thinking and reflection; artificial intelligence provides ample opportunities for personalised support of students' research activities, in particular, in the search for scientific information, data analysis, formulation of hypotheses and construction

of research models. The use of artificial intelligence improves learning efficiency and promotes the development of critical thinking; Big Data opens up new horizons for the development of analytical thinking and skills in processing large amounts of information. Working with real data develops a practical understanding of the structure of scientific research, teaches you to apply statistical and interpretive methods at the modern level.

Integration of gamification, artificial intelligence and Big Data technologies into the higher education system requires training of teachers, creation of an appropriate digital environment, adherence to the principles of academic integrity and ethical use of intellectual technologies. The integrated use of gamification, artificial intelligence and Big Data creates conditions for a new model of research-based learning, which is focused on individualising the educational process, developing the creative potential of the student, and integrating interdisciplinary knowledge and skills of the 21st century.

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