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The Importance Of Digital Technologies In The Creative Thinking Process Of Students' In Higher Education

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Abstract. This paper substantiates the didactic and psychological importance of digital technologies for fostering university students' creative thinking. The study aims to conceptually explain how digital learning environments, data-informed analytics, and collaborative platforms influence key stages of the creative process: problem reframing, idea generation, prototyping, and reflection. The methodology combines a systematic literature review, conceptual synthesis, instructional design principles, and an evaluation logic grounded in digital trace data. The scientific novelty lies in framing digital technologies not merely as instructional tools but as enabling conditions that elicit creative cognition, and in proposing an integrative didactic framework linking creativity indicators to measurable patterns of digital learning activity. The findings highlight that adaptive content delivery, rapid feedback cycles, and networked co-creation are central mechanisms through which higher education can develop students' creative competencies while maintaining transparency and assessability of learning outcomes.
Keywords. creative thinking; digital technologies; higher education; instructional design; collaborative learning; learning analytics; digital competence.

Oliy Ta'lim Yo'nalishlarida Talabalarning Kreativ Fikrlash Jarayonida Raqamli Texnologiyalarning A Hamiyati

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Annotatsiya. Mazkur maqola oliy ta'limda talabalarning kreativ fikrlash jarayonini qo'llab-quvvatlashda raqamli texnologiyalarning didaktik va psixologik ahamiyatini asoslashga qaratilgan. Tadqiqotning maqsadi raqamli ta'lim muhitlari, ma'lumotga asoslangan tahlil va kollaborativ platformalar kreativ fikrlashning muammoli vaziyatni qayta talqin qilish, g'oya generatsiyasi, prototiplash va refleksiya bosqichlariga qanday ta'sir qilishini konseptual model orqali tushuntirishdan iborat. Metodologiya sifatida tizimli adabiyot tahlili, konseptual-sintez, ta'lim dizayni yondashuvlari va raqamli izlar asosida o'quv jarayonini baholash mantiqi qo'llanildi. Ilmiy yangilik raqamli texnologiyalarni faqat vosita emas, balki kreativ fikrlashni yuzaga chiqaradigan shart-sharoitlar majmuasi sifatida talqin qilish, shuningdek, kreativlik indikatorlarini raqamli faoliyat ko'rsatkichlari bilan bog'laydigan integrativ didaktik ramkani taklif etishdan iborat. Natijalar oliy ta'limda kreativ kompetensiyalarni shakllantirishda adaptiv kontent, tezkor fikr-mulohaza va jamoaviy ijodning muhimligini ko'rsatadi.
Kalit so'zlar. kreativ fikrlash; raqamli texnologiyalar; oliy ta'lim; ta'lim dizayni; kollaborativ ta'lim; o'quv analitikasi; raqamli kompetensiya.

Роль Цифровых Технологий В Развитии Креативного Мышления У Студентов Вузов

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Аннотация. Настоящая статья направлена на обоснование дидактической и психологической значимости цифровых технологий в поддержке творческого мышления студентов в высшем образовании. Цель исследования состоит в концептуальном объяснении того, как цифровые образовательные среды, аналитика на основе данных и коллаборативные платформы влияют на этапы творческого процесса: переосмысление проблемной ситуации, генерацию идей, прототипирование и рефлексию. В качестве методологии использованы систематический анализ литературы, концептуально-синтетический подход, принципы instructional design и логика оценивания учебного процесса на основе цифровых следов. Научная новизна заключается в трактовке цифровых технологий не только как инструмента, но и как комплекса условий, инициирующих творческое мышление, а также в предложении интегративной дидактической рамки, связывающей индикаторы креативности с показателями цифровой активности. Полученные выводы подчеркивают роль адаптивного контента, оперативной обратной связи и совместного творчества в формировании творческих компетенций студентов.
Ключевые слова. креативное мышление; цифровые технологии; высшее образование; учебный дизайн; коллаборативное обучение; учебная аналитика; цифровая компетентность.

The development of creative thinking in higher education is becoming a central didactic task due to the rapidly changing demands of the labor market, the complexity of interdisciplinary problems, and the branched nature of knowledge production. Creativity is now interpreted not only as an individual ability specific to the fields of art or design, but as a set of cognitive and practical competencies such as diagnosing problem situations, combining different sources of knowledge, developing decisions in conditions of uncertainty, and being able to reasonably defend the result. As digital technologies have become more deeply embedded in the educational process, the possibilities for supporting creative thinking have expanded: simulations, multimodal content, collaborative documents, coding environments, generative modeling tools, as well as analytical assessment mechanisms based on digital traces of the learning process have appeared. However, these opportunities do not guarantee creativity in themselves; on the contrary, there is a risk of a mismatch between technology and pedagogy, a focus on assessment only on the final product, and the fact that digital tools enhance reproductive learning. Therefore, the issue is not the “existence” of digital technologies, but rather the scientific explanation of how they affect the stages and mechanisms of the creative thinking process. In international studies, the role of the digital environment in the development of creative thinking is interpreted through analytical approaches that make learning more visible, more collaborative, more immediate feedback, and more visible [1; 2]. In the Russian pedagogical school, concepts that link creativity with personal activity and problem-based learning prevail, and digital tools are seen as a condition for organizing this process [3]. Although digitalization processes have accelerated in the context of higher education in Uzbekistan, studies that consistently link the didactic model of digital technologies and assessment criteria for the purposeful formation of creative thinking have not been systematized sufficiently [4]. The purpose of this article is to conceptually analyze how digital technologies can support students' creative thinking processes in higher education and to propose an integrative didactic framework. The tasks are to divide the creative thinking process into stages and determine the functional capabilities of digital technologies for each stage; operationalization of creativity indicators through digital footprints and learning analytics; and justification of the harmony of technology, task, and assessment from the perspective of instructional design. The scientific novelty lies in the inclusion of digital technologies in the model as a set of conditions that generate creative thinking, as well as in the proposal of a conceptual solution that connects product and process indicators with digital performance indicators in the assessment of the creative process. The practical significance is manifested in the provision of methodological directions for designing tasks in higher education disciplines, managing collaborative projects, and strengthening formative assessment.

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The study is conceptually and methodologically based on three sources: first, theoretical interpretations of creative thinking as a cognitive process; second, approaches to digital pedagogy and instructional design; third, the logic of learning analytics and assessment based on digital footprints. As a database, scientific sources on creativity in higher education, digital learning environments, collaborative learning, formative assessment, and learning analytics have been selected since 2015; the selection prioritized theoretical articles, methodological reviews, and case studies with high relevance to the topic. The analysis process was carried out based on the logical stages of a systematic literature review: conceptual categories were distinguished, the results were compared, and the integration was integrated. The scientific basis for the methodological choice is that linking creative thinking with digital technologies requires a generalized model not only within a single empirical field, but also by synthesizing different scientific approaches. It was also noted that from the perspective of instructional design, the choice of technology should be viewed in a system with the openness of the task, the level of difficulty, the structures of collaboration and the assessment criteria [5]. As an assessment logic based on digital traces, indicators such as student actions on the platform, version history, discussions and comments, references to resources, and time-distributed activity were interpreted as proxy indicators of the creative process; however, it was accepted as a methodological limitation that such indicators are not directly creativity itself, but rather units of observation that increase the transparency of the process [2]. As a result, the conceptual analysis revealed that the support of creative thinking through digital technologies in higher education is explained by five interrelated mechanisms. The first mechanism is related to the enhancement of the reinterpretation of the problem situation: digital environments allow for the rapid accumulation, visualization and comparison of information in different formats, which creates conditions for the student to see the problem from several perspectives. The second mechanism is manifested in the divergent stage of idea generation: collaborative whiteboards, online brainstorming tools, synchronous and asynchronous work on shared documents, and the use of open knowledge sources increase the number and diversity of ideas. The third mechanism accelerates prototyping and modeling: simulators, coding environments, digital labs, and design tools support the student's learning from mistakes by establishing a "fast test, fast conclusion" cycle. The fourth mechanism is explained by increasing the density of formative feedback: automated checks, rubric-based electronic assessments, peer reviews, and teacher micro-comments provide direction throughout the process. The fifth mechanism deepens reflection: version history, portfolios, journaling applications, and activity logs allow the student to review the chain of decisions, understand their strategies, and transfer them to subsequent tasks. Based on these mechanisms, an integrative didactic framework was developed: in it, the creative thinking process was divided into four stages (reinterpretation, idea generation, prototyping, reflection) and for each stage, the appropriate class of digital tools, task design parameters, and evaluation indicators were linked. Evaluation indicators were defined in a two-layered form: product indicators (level of novelty, relevance, validity, aesthetic or functional integrity) and process indicators (number of idea variants, frequency of iterations, intensity of collaboration, percentage of changes based on feedback, depth of reflection). The resulting principle was that digital traces simplify the measurement of process indicators, but their substantive interpretation must necessarily be accompanied by qualitative analysis and taking into account the context. Three conditions were also identified for digital technologies to support creative thinking: open and multi-solution tasks; the dominance of the formative nature of assessment; and integrated management with the norms of digital competence and academic integrity.

The results obtained indicate the need to view digital technologies not as a universal factor that "enhances" creativity, but as a system of conditions that are effective only when combined with a specific pedagogical design. This approach is consistent with modern views that call for assessing the iterative nature of the creative process, rather than measuring creativity solely by the novelty of the final product. The international literature shows that digital environments enhance collaboration and support reflection as sustainable factors of creative outcomes; in particular, it is emphasized that learning analytics allow for the organization of formative assessment based on information [1; 2]. This aspect is emphasized in the framework we propose: digital traces can make assessment "transparent", but they do not automatically measure the semantic and contextual aspects of creativity. Therefore, analytics that are not combined with teacher interpretation, rubrics and quality criteria are likely to lead to erroneous conclusions. In the Russian scientific tradition, problem-based learning and activity approaches are seen as sources of creative thinking; digital tools are interpreted as tools for organizing

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a problem situation and managing activity [3]. Our results extend this position and conceptually substantiate the idea that digital technologies are not limited to “displaying” a problem situation, but also systematically support the iterative prototyping and reflection of the student. In the context of Uzbek higher education, the main problem often appears in the gap between the availability of technology and the lack of methodology: even when LMS or platforms are introduced, tasks often remain around closed tests and reproductive activities, as a result, the share of open tasks requiring creativity decreases [4]. The proposed framework more clearly indicates the parameters of instructional design to reduce this gap: the openness of the task, the role of the collaborative structure, the coherence of feedback loops and assessment indicators. The limitations of the study are that the article is conceptually synthetic and does not have a large-scale empirical study across individual universities; in addition, confidentiality, ethical consent, and data quality requirements should always be a priority when assessing based on digital footprints. Future directions include pilot testing the framework across disciplines, testing the psychometric reliability of creativity indicators, and developing training modules for teachers on digital didactic design. In addition, developing assessment designs that promote creativity while ensuring academic integrity in the context of generative digital tools is an urgent scientific and practical task [6].

These data provide a conceptual justification for the importance of digital technologies in the process of creative thinking of students in higher education and show that their impact is manifested through various mechanisms at the stages of reinterpretation of the problem situation, idea generation, prototyping and reflection. The proposed integrative didactic framework connects the class of digital tools, task design parameters and assessment indicators into a single logical system and justifies the need to assess creativity not only by the final product, but also by the iterative and collaborative features of the process. Digital traces can make formative assessment transparent and deepen reflection, but their meaningful interpretation should be inextricably linked to the teacher's methodological decisions. In general, for digital technologies to be effective in developing creative thinking, an educational design that combines open tasks, rapid feedback, collective creativity and process indicators of assessment is required.

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