

**IMPROVING THE CREATIVE COMPETENCIES OF FUTURE TEACHERS IN
THE CONTEXT OF DIGITALIZATION BASED ON QUEST AND FORESIGHT
TECHNOLOGIES**

Rahmonova Nilufar

Teacher of the Department of Pedagogy and Psychology,
Denov Institute of Entrepreneurship and Pedagogy

X. Introduction

In the rapidly evolving landscape of education, the imperative to enhance the creative competencies of future teachers becomes increasingly pronounced, particularly within the framework of digitalization. By harnessing quest and foresight technologies, educational frameworks can be re-engineered to cultivate adaptive and innovative educators capable of navigating the complexities of a digital age. As emphasized in (Heinonen et al., 2025), the future of work necessitates an amalgamation of critical thinking, empathy, and hybrid skill sets, which must be instilled in teaching methodologies. This shift is particularly crucial in the context of further education, as outlined in (Scott et al., 2025), which highlights the disparities faced by educators in maintaining relevant professional development amidst such transformation. Finally, the approach delineated in (Almrott et al., 2025) regards Low-tech solutions as a foundational element in fostering not only sustainability but also creativity among future educators, reinforcing the notion that empowerment through practical skills will be vital for addressing contemporary challenges. Collectively, these insights underscore the need for a strategic framework aimed at enhancing the creative capacities of future teachers in an increasingly digitized world.

A. Definition of creative competencies in education

At the intersection of education and creativity lies the critical concept of creative competencies, which encompass the skills, knowledge, and attitudes necessary for innovation and problem-solving within an educational context. Creative competencies are not merely individual traits but are cultivated through collaborative experiences, promoting adaptive thinking and resilience. In the current climate of digitalization, these competencies become increasingly vital as future teachers must navigate complex technological landscapes while also fostering the same abilities in their students. A case in point is the LT4SUSTAIN project, which emphasizes practical engagement in sustainable design strategies to enhance inclusivity and creativity in educational settings (Almrott et al., 2025). Furthermore, the findings from longitudinal studies like The Imprint of Education highlight the importance of developing a holistic educational framework that shapes creative competencies and societal engagement among educators (N/A, 2025). In this digital era, empowering future teachers with these skills can significantly enhance social innovations and address pressing global challenges (Augsten et al., 2025)(Kyakunda et al., 2025).



INTRODUCTION OF NEW INNOVATIVE TECHNOLOGIES IN EDUCATION OF PEDAGOGY AND PSYCHOLOGY.

International online conference.

Date: 27th May-2025

Definition	Components	Importance
Creative competencies are the knowledge, skills, and attitudes that enable individuals to generate novel ideas, solve problems, and produce original and valuable outcomes. These competencies are essential for adapting knowledge to new contexts and fostering innovation. ([peopleforeducation.ca](https://peopleforeducation.ca/mwm-defining-the-competencies/?utm_source=openai))	Creative competencies encompass imagination, critical thinking, and the ability to collaborate effectively. They involve generating new ideas, evaluating them critically, and working with others to develop and implement these ideas. ([curriculum.gov.bc.ca](https://curriculum.gov.bc.ca/competencies/thinking/creative-thinking?utm_source=openai))	In the context of education, creative competencies are vital for preparing students to navigate complex and rapidly changing environments. They contribute to problem-solving abilities, adaptability, and the capacity to engage in innovative practices. ([er.educause.edu](https://er.educause.edu/articles/2018/3/creative-know-how-competencies-for-student-success-in-a-world-of-change?utm_source=openai))
Creative competencies refer to the mix of knowledge, skills, and attitudes that allow individuals to deal with challenges, solve problems, and produce original and novel ideas or products. ([igiglobal.com](https://www.igiglobal.com/dictionary/activating-teacher-competencies-through-designing-gamified-stories-with-augmentative-reality/119269?utm_source=openai))	These competencies include fluency (the ability to generate numerous ideas), flexibility (the capacity to explore diverse perspectives), originality (producing unique ideas), and elaboration (adding depth and detail to concepts). ([reimaginedschools.com](https://reimaginedschools.com/fostering-creativity-in-the-classroom-part-4-defining-creativity/?utm_source=openai))	Developing creative competencies is crucial for fostering resilience, resourcefulness, and confidence in students, which are positively linked to engagement, achievement, and innovation. ([peopleforeducation.ca](https://peopleforeducation.ca/mwm-defining-the-competencies/?utm_source=openai))

Creative Competencies in Education

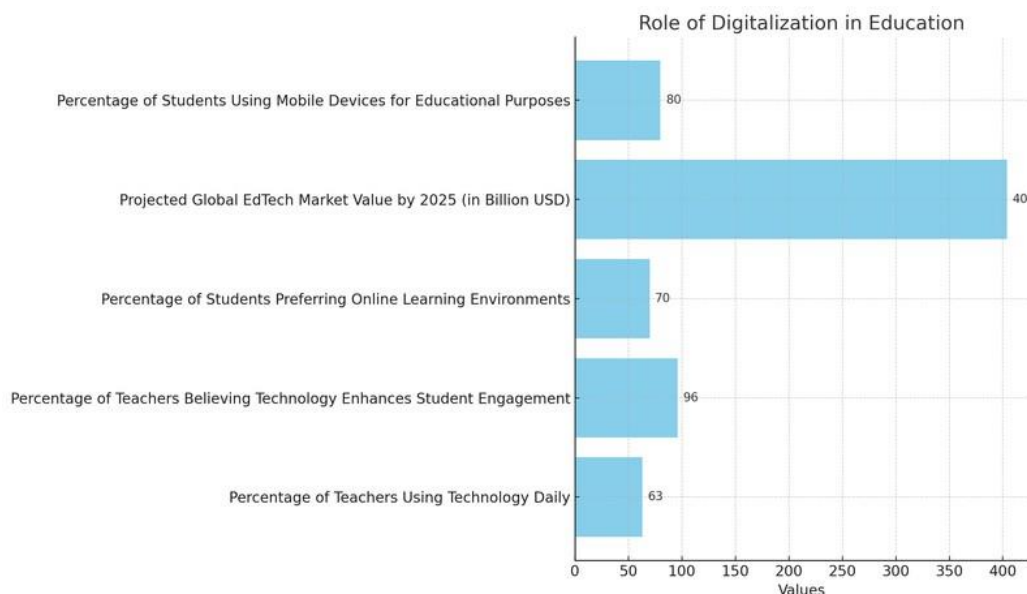
B. Importance of digitalization in teaching and learning

The integration of digitalization into teaching and learning is paramount for cultivating the creative competencies needed in future educators. It fosters an adaptive learning environment that transcends traditional classroom boundaries, enabling personalized education and innovative pedagogical strategies. As highlighted in recent studies, the transformation of higher education through digital means facilitates a more comprehensive and interactive learning experience, allowing both educators and students to engage with diverse resources effectively (Yin X et al., 2025). Moreover, digital tools significantly enhance language acquisition and instructional methodologies, as seen in the context of indigenous language education, where digital resources proved to substantially impact learning outcomes (Ukaegbu NM et al., 2025). This shift parallels broader societal changes in the workplace, where new competencies, including hybridization of work and the accommodation of personal values, emerge as essential for future success (Heinonen S et al., 2025). Collectively, these insights underscore the critical role that digitalization



Date: 27th May-2025

plays in reimagining educational environments and improving creative competencies among future teachers.



The chart displays various metrics regarding the role of digitalization in education. It highlights that a significant percentage of teachers use technology daily (63%) and believe it enhances student engagement (96%). Additionally, 70% of students prefer online learning environments, and 80% use mobile devices for educational purposes. Notably, the projected global EdTech market value by 2025 is substantial at 404 billion USD, indicating strong growth in this sector.

C. Overview of quest and foresight technologies

A comprehensive overview of quest and foresight technologies reveals their critical role in enhancing creative competencies among future educators. These technologies facilitate experiential learning through immersive environments that simulate real-world challenges, thereby fostering innovative problem-solving and adaptive thinking. By leveraging insights from structured interviews conducted for the T-winning Spaces 2035 project, it becomes evident that the fusion of work and leisure, driven by digitalization, necessitates a re-evaluation of pedagogical approaches (Heinonen et al., 2025). Furthermore, research on digital professional development in further education highlights the urgency for educators to engage in self-directed learning that aligns with current technological demands, reinforcing the need for adaptability (Scott et al., 2025). Additionally, initiatives like LT4SUSTAIN emphasize the importance of low-tech solutions in promoting sustainability and inclusivity, which are vital competencies in a rapidly evolving educational landscape (Almrott et al., 2025). Ultimately, the integration of these technologies not only prepares teachers for the digital age but also cultivates an environment where creativity can flourish amidst continuous change (N/A, 2025).

XI. The Role of Digitalization in Enhancing Creative Competencies

Digitalization serves as a pivotal force in enhancing the creative competencies of future teachers by fostering an environment that encourages innovative thinking and adaptability. Through the integration of digital tools, such as automated strategic planning

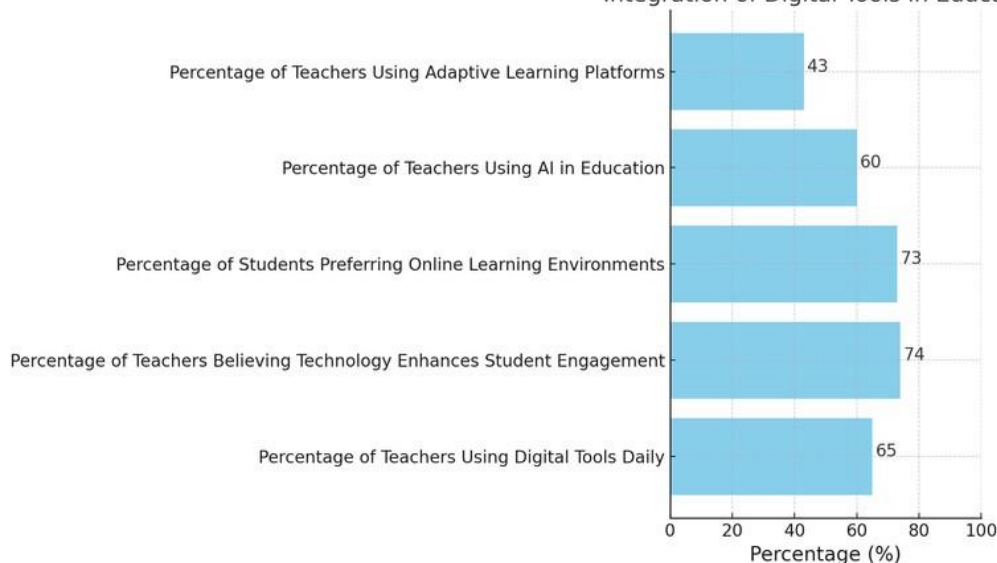
Date: 27th May-2025

systems, educators can streamline administrative tasks and focus more on pedagogical creativity and student engagement (Al-Shamsi IR, 2025). Moreover, the embrace of digital literacy within academic libraries enriches the educational landscape by equipping future teachers with essential skills to navigate and utilize digital resources effectively, ultimately enhancing their teaching methodologies (Guo et al., 2025). Research indicates a pressing need to explore the contours of digitalization in developing sustainable and future-oriented competencies, particularly in vocational education contexts (Alanko-Turunen et al., 2025). As organizations strive to cultivate resilient educational frameworks, generative practices that leverage technology will be critical in navigating the evolving landscape of education (Sagan et al., 2025). Together, these insights underscore the transformative potential of digitalization in shaping the creative capabilities of tomorrows educators.

A. Impact of digital tools on teaching methodologies

The integration of digital tools into teaching methodologies has transformed the pedagogical landscape, facilitating innovative approaches to education. The COVID-19 pandemic catalyzed a shift towards more adaptive and technology-driven methods, highlighting the necessity for educators to develop digital competencies that align with modern educational demands (Scott et al., 2025). Through platforms that support collaborative learning and shared practices, teachers have begun to experience increased autonomy and relevance in their instructional strategies, which are critical for fostering creative competencies (Scott et al., 2025). Moreover, as entrepreneurship education becomes pivotal in preparing students for dynamic environments, integrating digital frameworks enhances the effectiveness of pedagogical approaches. The emphasis on low-tech solutions within project-based learning also underscores the importance of accessibility and sustainability in design-focused education, reinforcing the need for educators to adapt their methodologies to cultivate an innovative mindset among future teachers (Almrott et al., 2025)(Augsten et al., 2025). Thus, the impact of digital tools is profound, reshaping how education is delivered and experienced.

Integration of Digital Tools in Education



Date: 27th May-2025

This bar chart illustrates the integration of digital tools in education, highlighting the percentages of teachers and students engaging with various technologies. The data shows a strong adoption of digital tools among teachers, a high belief in technology's ability to enhance student engagement, and a significant preference for online learning environments among students. However, the use of AI in education and adaptive learning platforms appears to be less prevalent.

B. Integration of technology in curriculum design

The integration of technology in curriculum design plays a pivotal role in enhancing the creative competencies of future teachers amidst ongoing digitalization. As education systems adapt to the rapid advancements in information technology, curricula must evolve to incorporate digital tools that foster innovation and engagement among educators and students alike. Emphasizing the development of personalized education models, digital literacy, and ethical standards within academic frameworks is essential for aligning educational practices with contemporary needs (Ukaegbu NM et al., 2025). Furthermore, leveraging digital resources can significantly impact learning outcomes, particularly in marginalized language programs, thereby enhancing the overall teaching and learning experience (Yin X et al., 2025). The insights from educational leaders highlight the necessity of collaborative strategies that build resilience within learning environments, thus promoting a knowledge-based society capable of competing globally (Zaidan E et al., 2025). Consequently, the thoughtful integration of technology not only enriches curriculum design but also equips future teachers with essential skills for navigating an increasingly complex educational landscape (Elżbieta PAWŁOWSKA et al., 2025).

C. Digital literacy as a foundation for creativity

In an era increasingly dominated by digital technologies, fostering digital literacy among future teachers emerges as a crucial foundation for enhancing creativity within educational frameworks. The profound interplay between digital skills and creative competencies is particularly relevant as educators navigate the complexities of modern pedagogy. Research reveals that the COVID-19 pandemic catalyzed significant shifts in digital professional development, highlighting the necessity for educators to engage in self-directed learning and adopt adaptive teaching methods to meet evolving educational demands (Scott et al., 2025). Notably, the incorporation of digital tools into pedagogical practices not only facilitates traditional curricula but also nurtures entrepreneurial mindsets essential for fostering innovation in the classroom (Aguma et al., 2025). Moreover, initiatives such as hackathons aim to promote sustainable solutions through the application of low-tech principles, thereby enriching the educational experience and igniting creativity (Almrott et al., 2025). Ultimately, enhancing digital literacy can empower future teachers to harness technology effectively, leading to more dynamic and creative learning environments.

XII. Quest Technologies and Their Application in Teacher Training

In the rapidly evolving educational landscape, Quest technologies emerge as vital tools for enhancing teacher training and fostering creative competencies among future



Date: 27th May-2025

educators. These technologies not only facilitate the development of digital literacy, as demonstrated by the application of WebQuest in various educational contexts, but also promote critical thinking and autonomous learning essential for contemporary pedagogy (Nasrulloh et al., 2025). Furthermore, the integration of Quest technologies in teacher training aligns with broader institutional goals by cultivating a structured approach to online education, which emphasizes clear course structures and inclusive learning activities (N/A, 2025). Additionally, the emphasis on inclusive education through digital tools ensures that aspiring teachers can cater to the diverse needs of their future students, thereby enhancing the overall educational environment (Carmen del Navas-Bonilla R et al., 2025). Thus, embracing Quest technologies in teacher training represents a transformative step toward preparing educators who are not only technologically proficient but also creatively agile in a digitalized learning context.

A. Definition and examples of quest technologies

Quest technologies represent a transformative framework that integrates digital tools and innovative methodologies to enhance learning experiences, particularly in educational settings. These technologies, which include gamification, interactive simulations, and augmented reality, create immersive learning environments that engage students and facilitate deeper understanding. For instance, quest-based learning strategies allow educators to design challenges or missions that students must solve, encouraging critical thinking and collaboration. Moreover, as highlighted in research on the evolution of workspaces and competencies in a digital age, such as the need for empathy and critical thinking (Heinonen et al., 2025), quest technologies can significantly contribute to the skill sets of future teachers. These educators must adapt to and leverage such technologies to foster creativity and problem-solving abilities in their students, ultimately addressing the skills gap identified during the pandemic and emphasized further through studies on digital professional development in education (Scott et al., 2025). This approach aligns with the overarching goal of preparing educators to meet the challenges posed by technological advancements (Almrott et al., 2025)(N/A, 2025).

B. Benefits of experiential learning through quest-based approaches

Experiential learning via quest-based approaches plays a pivotal role in enhancing the creative competencies of future teachers amid the challenges of digitalization. By providing immersive, hands-on experiences, these methodologies allow educators to engage deeply with content, fostering critical thinking and problem-solving skills essential in contemporary classrooms. Such learning frameworks not only motivate students but also cultivate collaboration and communication skills through shared tasks, aligning with the dynamic needs of teaching in the digital age. For instance, diverse strategies developed in various contexts, like the integration of mobile learning technologies and social networking platforms, have shown to significantly improve engagement and learning outcomes ((Alam S, 2025)). Additionally, the application of foresight technologies enables educators to anticipate emerging educational trends, thus enriching their instructional approaches ((Wang M et al., 2025)). As teachers navigate cognitive loads in innovative



INTRODUCTION OF NEW INNOVATIVE TECHNOLOGIES IN EDUCATION OF PEDAGOGY AND PSYCHOLOGY.

International online conference.

Date: 27th May-2025

environments, addressing these demands through quest-based learning can lead to adaptive practices and resilience in teaching methodologies ((Alruwaili R et al., 2025)).

Benefit	Statistic
Improved Cognitive Achievement	Preservice technology educators engaging in experiential learning activities showed statistically significant cognitive achievement differences compared to those who did not engage in such activities. (p-value < 0.0001)
Enhanced Student Engagement	81% of students believe it's important for schools to offer real company-led projects, and 79% value on-the-job learning experiences during their postsecondary education.
Increased Self-Confidence	Educators participating in authentic astronomy research programs reported that 14% found the experience 'life-changing', and at least 12% changed career paths substantially due to the program.
Improved Attitudes Toward Science	Pre-service teachers in inquiry-based science courses significantly increased their confidence, enjoyment, and perceptions of relevance toward science, while those in traditional lecture-style classes experienced a decline in favorable attitudes.
Enhanced Classroom Engagement	Experiential learning positively influences students' health and well-being, leading to improved classroom engagement and motivation.

Benefits of Experiential Learning in Teacher Education

C. Case studies of successful implementation in teacher education

The implementation of transformative educational practices in teacher education can greatly enhance the creative competencies of future educators, particularly in the context of digitalization. Case studies reveal that initiatives such as the LT4SUSTAIN project effectively engage educators and students in developing low-tech solutions to address societal challenges, thereby fostering creativity through practical involvement (Almrott et al., 2025). Additionally, research on the Mastercard Foundation Scholars Program illustrates how structured educational frameworks can establish comprehensive support systems, encouraging graduates to utilize digital technologies in innovative ways (N/A, 2025). However, disparities in access to information and communication technologies (ICT) highlight the challenges faced by women entrepreneurs in the educational domain, suggesting that teacher training must incorporate strategies to bridge this digital divide (Kyakunda et al., 2025). Furthermore, discourses at the recent DGTF conference stress the importance of measuring designs impact on educational practices, underlining a critical examination of existing methodologies to ensure equitable implementation (Augsten et al., 2025).

Institution	Country	Program	Year	Details	Source
Norwegian	Norway	Professio	2017	Implemented PDC	https://www.idunn.no/doi/fu



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International online conference.

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Teacher Education Institutions		nal Digital Competence (PDC) Training		training in all grade 1–10 teacher education programs; government funding received by five institutions in 2018; varied conceptualizations and implementations of PDC across institutions.	11/10.18261/njdl.17.1.2
Freeport School District	USA	Model Schools Program	2015–2018	Collaborated with Nassau BOCES to integrate instructional technology; provided 100 Model Schools days for professional development; supported teachers in technology integration.	https://www.nysed.gov/education/nassau-boces-instructional-technologies-transforming-education-how-model-schools-program-has
Swiss Primary Schools	Switzerland	Digital Education Curricular Reform	2021	Implemented an adapted cascade model for teacher professional development; involved 14 teacher-trainers and 700 teachers; aimed to scale digital education reforms effectively.	https://link.springer.com/article/10.1007/s10639-023-12043-6
Hong Kong Primary Schools	Hong Kong	Technology-Integrated Continuous Professional Development	2020	Conducted 16 sessions combining face-to-face and online meetings; focused on planning and implementing English literature units using technology; supported teachers during class suspension due to the pandemic.	https://pmc.ncbi.nlm.nih.gov/articles/PMC10251171/
Eastern Metropolitan Senior High	Australia	Technology Education Program	1989	Implemented a school-coordinated approach involving all subject areas; emphasized effective communication and devolution of responsibility; achieved high-level integration of technology in curricula.	https://jte-journal.org/articles/10.21061/jte.v5i1.a.4

Case Studies of Successful Implementation in Teacher Education Digitalization

XIII. Foresight Technologies and Future-Oriented Teaching Strategies

Date: 27th May-2025



The integration of foresight technologies into educational paradigms is pivotal for enhancing the creative competencies of future teachers, particularly in the context of ongoing digitalization. By leveraging innovative methodologies such as hackathons and experiential learning, educators can cultivate an environment that encourages real-world problem-solving and adaptability among students, essential skills for navigating the complexities of modern teaching (Almrott et al., 2025). Foresight technologies enable educators to anticipate changes in educational needs and to align curricula with the demands of the future workforce, thereby fostering a proactive teaching approach (Sagan et al., 2025). Moreover, as digital tools continue to reshape traditional learning spaces, educators must reassess how technology can serve peacebuilding and social justice initiatives within curriculum frameworks (Spring et al., 2025). Ultimately, the emphasis on generative education informs a holistic understanding of teaching and learning, equipping future educators with the tools necessary to respond creatively and effectively to emerging challenges (N/A, 2025).

A. Understanding foresight technologies and their relevance

The relevance of foresight technologies in education becomes increasingly apparent as institutions strive to innovate and adapt in a rapidly digitalized landscape. These technologies facilitate strategic planning, enabling educators to anticipate future trends and challenges within the teaching and learning environments. For example, the automation and digitalization of strategic planning have been shown to enhance decision-making processes in higher education, ultimately supporting academic excellence and global recognition (Al-Shamsi IR, 2025). Additionally, current research emphasizes the importance of integrating digitalization and artificial intelligence to develop future competencies and sustainable practices in vocational education (Alanko-Turunen et al., 2025). The ongoing evolution of workforce dynamics, driven by automation and remote work, highlights the necessity for educational frameworks that incorporate foresight technologies to prepare future teachers adequately (Sagan et al., 2025). By addressing these factors, educational institutions can cultivate creative competencies, fostering resilience and adaptability among future educators in an increasingly complex global landscape (Spring et al., 2025).

B. Developing critical thinking and problem-solving skills

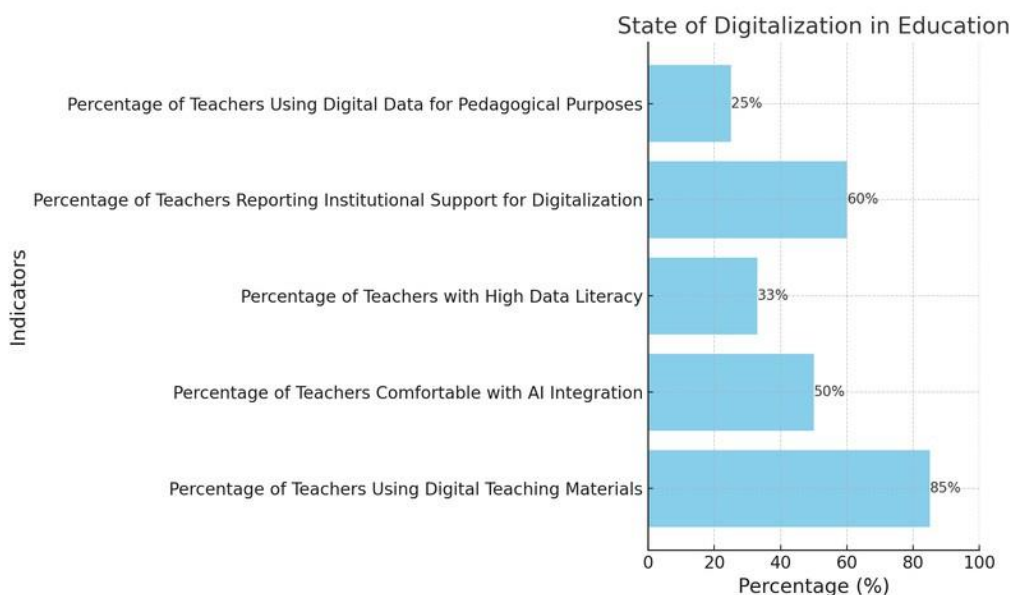
In the contemporary educational landscape, fostering critical thinking and problem-solving skills is essential for future teachers, particularly within the context of digitalization and emerging technologies. The integration of quest and foresight technologies offers innovative pathways to enhance these competencies, enabling educators to navigate complex challenges effectively. For instance, initiatives like LT4SUSTAIN demonstrate how hackathons and hands-on activities can equip future educators with practical problem-solving skills rooted in sustainability and low-tech principles, supporting (Almrott et al., 2025). Similarly, insights from longitudinal studies highlight the impact of technology on learning outcomes, emphasizing the need for educational frameworks that promote critical engagement among students (N/A, 2025).

Date: 27th May-2025

Furthermore, the discourse surrounding design and its societal implications underscores the necessity for teachers to critically assess their roles and responsibilities in shaping educational environments (Augsten et al., 2025). Ultimately, equipping future teachers with these skills ensures they can foster an adaptive and innovative learning culture, vital in today's rapidly changing world (Kyakunda et al., 2025).

C. Preparing teachers for future challenges in education

In today's rapidly evolving educational landscape, preparing teachers to navigate future challenges is paramount, particularly as digitalization reshapes pedagogical practices. To enhance creative competencies among future educators, institutions must integrate innovative teaching frameworks that emphasize collaboration and technology integration, as evidenced by the trends illuminated in recent studies. For instance, the findings from the scoping literature review indicate a pronounced need for research on digitalization, highlighting the importance of student-centered learning approaches in the context of vocational and higher education (Alanko-Turunen et al., 2025). Furthermore, the focus on peace education in diverse environments, such as Sri Lanka, reinforces the necessity of leveraging technology to foster resilience and adaptability among learners (Spring et al., 2025). Additionally, initiatives like LT4SUSTAIN and their emphasis on Low-tech solutions exemplify how practical engagement can empower teachers to develop sustainable educational practices that respond to real-world issues (Almroth et al., 2025). Thus, ensuring that educators are equipped with the skills fostered through foresight and exploratory technologies becomes essential for cultivating a dynamic learning environment (Oduor et al., 2025).



The chart illustrates various percentages related to the digitalization in education. It shows that 85% of teachers use digital teaching materials, while only 25% use digital data for pedagogical purposes. Additionally, there is a significant gap in comfort and capability, as only 50% feel comfortable with AI integration, 33% possess high data literacy, and 60% report receiving institutional support for digitalization. This highlights

Date: 27th May-2025

the ongoing challenges and areas for improvement in the integration of digital tools in educational settings.

XIV. Conclusion

In conclusion, the imperative to enhance the creative competencies of future teachers amid the rapid digitalization of education cannot be overstated. The integration of quest and foresight technologies provides a transformative opportunity to reshape pedagogical practices, equipping educators with the skills needed to navigate and leverage technological advancements effectively. By fostering a culture of creativity and innovation, teacher education programs can prepare educators to engage students meaningfully, promoting adaptive learning environments that embrace diversity and critical thinking. Moreover, the strategic implementation of these technologies ensures that teachers remain proactive rather than reactive in their approach to changing educational landscapes (Facer K, 2011-03-29). Ultimately, cultivating creative competencies not only benefits future teachers but also enriches the learning experiences of their students, thereby laying a foundation for a more dynamic and responsive educational framework (Facer K, 2011-03-29). Embracing this educational evolution is essential for the sustainability and relevance of teaching in the digital age.

A. Summary of key findings

The key findings from the research underscore the urgency of integrating creative competencies in teacher education, particularly within the framework of digitalization. The studies emphasize that equipping future teachers with skills in both Quest and Foresight Technologies is crucial for fostering innovative educational practices. Notably, (N/A, 2025) illustrates the transformative potential of technology in bridging gaps in educational access and creativity, while (Almrott et al., 2025) highlights the importance of hands-on experiences, such as hackathons, in developing sustainable design practices. Furthermore, challenges related to the digital divide, as outlined in (Kyakunda et al., 2025), further complicate the landscape, necessitating targeted strategies to enhance digital literacy among educators. Lastly, (Augsten et al., 2025) contributes to this discourse by critiquing traditional design methodologies, advocating for an inclusive approach that considers diverse perspectives and social implications in educational contexts. Collectively, these findings advocate for a holistic approach to teacher training, ensuring educators are adequately prepared for the future.

B. Implications for teacher education programs

The integration of quest and foresight technologies in teacher education programs presents significant implications for enhancing the creative competencies of future educators. As digital tools evolve, teacher preparation must adapt to foster innovative pedagogical strategies that embrace creativity and critical thinking. Programs should incorporate experiential learning opportunities where prospective teachers engage with digital platforms designed to stimulate collaborative problem-solving and creative projects. This approach not only nurtures teachers digital literacy but also encourages an adaptive mindset essential in today's dynamic educational landscape. Furthermore, continuous



Date: 27th May-2025

professional development rooted in emerging technologies allows educators to conversely model the very creativity they aim to instill in their students. Ultimately, redefining teacher education through the lens of digitalization not only equips future teachers with necessary skills but also cultivates an educational environment that prioritizes innovation and adaptability, thereby preparing them for the complexities of 21st-century classrooms (Facer K, 2011-03-29)(Facer K, 2011-03-29).

C. Future directions for research and practice in creative competencies

Future research and practice in creative competencies must integrate the evolving landscape of digitalization and technological advancements while addressing the unique challenges posed by diverse educational environments. As demonstrated in studies examining the impact of digital tools on strategic planning within higher education, the necessity for automating processes and fostering innovative thinking is paramount (Al-Shamsi IR, 2025). Furthermore, enhancing digital literacy in academic libraries underscores the urgent need for educational institutions to embrace new methodologies that foster high-quality development (Guo et al., 2025). Additionally, exploring the implications of megatrends such as automation and remote work within educational frameworks can help educators better prepare for future challenges, thus driving resilience and adaptability (Sagan et al., 2025). Finally, interdisciplinary approaches that merge technology and education, particularly in conflict-affected regions, highlight the potential for peace-focused educational initiatives, revealing a critical area for further exploration in the realm of creative competencies (Spring et al., 2025).

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