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Interactive methods aimed at improving the quality of creativity of students studying in the field of agricultural education

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Abstract
In an era where traditional pedagogical approaches often fail to engage students meaningfully, a paradigm shift towards interactive methods has emerged as a vital strategy in fostering creativity, particularly within agricultural education. This educational sector faces unique challenges, including the need to innovate sustainable practices amidst a rapidly changing global landscape. Traditional lectures and rote memorization rarely cultivate the adaptive thinking required for successful problem-solving in agricultural contexts. By integrating interactive techniques, such as collaborative projects, experiential learning, and technology-enhanced simulations, educators can create immersive learning environments that encourage students to explore, experiment, and apply their knowledge in real-world scenarios. This paper will explore the impacts of such methods on student creativity, drawing on theoretical frameworks and empirical research that illuminate the relationship between interactive learning and creative development in agricultural education, ultimately advocating for their incorporation as a standard practice in curricula.
Keywords:agricultural education context, innovation challenges and solutions, interactive methods aimed at improving creative activity.

Introduction. In the context of agricultural education, creativity transcends mere artistic expression to encompass innovative problem-solving skills essential for addressing complex agricultural challenges. This multifaceted concept demands that students not only engage with existing knowledge but also synthesize new ideas and approaches relevant to their field. A seminar setting can facilitate this by promoting professional dialogue, where graduate students articulate and refine their research problems, thereby enhancing their critical thinking and writing skills (Garcia et al.). Such interactions serve as valuable opportunities for students to collaborate, share insights, and explore diverse perspectives, creating an environment conducive to creative development. Furthermore, employing simulation and gaming methods can further enrich this creative process by allowing students to engage in experiential learning, which stimulates imagination and fosters a natural inclination towards inquiry and exploration (Слатвинська et al., 2015). Ultimately, defining creativity in agricultural education involves recognizing it as a vital skill that empowers students to think critically and develop innovative solutions to real-world problems.

Creativity serves as a cornerstone for driving agricultural innovation, particularly in an era characterized by rapid technological advances and shifting environmental conditions. In a sector traditionally viewed through a lens of established practices and methodologies, the ability to think divergently and develop novel solutions is essential for farmers to enhance productivity and sustainability. Research highlights that farmer-inventors often draw upon their tacit knowledge and practical skills to create unique solutions that address specific challenges on their farms (High et al., 2018). This suggests that fostering a creative mindset in agricultural education can empower future professionals to not only adopt innovations but also contribute to the development of new technologies and practices, ultimately aiding in the viability of family farms. Furthermore, the insufficient support from Agricultural Knowledge and Innovation Systems (AKIS) for farmer-led innovation underscores the need for educational frameworks that emphasize creativity and collaboration among students (Rockefeller Foundation, 2000). Thus, cultivating creativity within agricultural education is not merely beneficial; it is imperative for the evolution of the agricultural sector.

Engaging students in agricultural education through interactive methods has emerged as an essential strategy for fostering creativity and innovation. Interactive methods, such as collaborative learning, problem-solving exercises, and participatory research, promote active involvement in the educational process, allowing students to apply theoretical knowledge to real-world scenarios. This aligns with the growing recognition

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that education should not merely transmit information but cultivate a continuous process of adaptation and innovation among students. For instance, the concepts of innovation systems and platforms highlight the importance of connecting all actors in the agricultural value chain, ensuring students develop practical skills and creativity (cite5). Moreover, employing hybrid approaches like Rapid Situation Analysis in field studies encourages students to engage with diverse stakeholders, enhancing their understanding of sustainable practices and corporate responsibility in agriculture (cite6). By integrating these interactive methods, educators can significantly elevate the quality of creativity among students, preparing them for the complexities of contemporary agricultural challenges.

The pursuit of innovative teaching methodologies in agricultural education is underscored by the necessity to enhance student creativity through interactive engagement. The primary objective of this research is to explore the effectiveness of various interactive teaching methods in cultivating the creative capacities of students within this field. By analyzing approaches that incorporate digital tools and collaborative learning strategies, the study seeks to identify best practices that can foster a more dynamic educational environment. Importantly, this inquiry acknowledges the essential role of technology in modern pedagogy, as supported by research highlighting the effectiveness of e-learning platforms like Google Classroom in enhancing instructional delivery ((Amalia et al., 2023)). Furthermore, understanding the specific educational needs in the agricultural sector, particularly through innovation and entrepreneurship, aligns with the goal of preparing students for contemporary challenges in food systems ((Barrera C. et al., 2021)). Hence, the research aims to equip educators with strategies to effectively nurture creativity, ensuring students can thrive both academically and professionally.

The exploration of interactive methods in agricultural education serves not only to enhance creativity but also to address critical gaps in existing pedagogical approaches. Engaging students through dynamic, technology-supported platforms fosters an environment conducive to innovative thinking, crucial in an ever-evolving field like agriculture. The incorporation of open-source tools, such as OEMDE Moodle, offers opportunities for developing interactive content that engages students actively, thereby enhancing their cognitive capabilities (Olga V. Nazarova et al., 2021). Moreover, the adaptability of these tools can cater to diverse learning styles, ensuring inclusivity, which is essential for effective education in multidisciplinary settings. This study also highlights the potential of digital platforms to support collaborative ideation processes, suggesting that their application can accelerate technological innovations in agriculture by integrating insights from various disciplines (EssiRyymin et al., 2020). Ultimately, the findings underscore the importance of innovation in educational strategies to prepare students for future challenges in the agricultural sector.

Structure of the research paper

Within the framework of academic discourse, the structure of anresearch paper serves as a blueprint that guides the reader through the authors argument. Each section must coherently build on the previous one to create a narrative that not only informs but also engages the audience. In the context of agricultural education, where interactive methods are explored, establishing a clear structure is crucial. For instance, an introductory paragraph may outline the significance of creativity in agricultural practices, leading seamlessly into a middle section that elaborates on various interactive strategies designed to enhance this creativity. This systematic progression allows for a logical flow of ideas, which is essential for maintaining reader engagement and understanding. As underscored in the National Collegiate Honors Councils discourse on community engagement and experiential learning (Long et al., 2023), the effective structuring of anresearch paper can transform abstract concepts into tangible applications, fostering a deeper appreciation of the subject matter. A well-defined conclusion then encapsulates the discussion, reiterating the essential insights presented while emphasizing the broader implications for students in the field (Rockefeller Foundation, 2000).

Understanding the theoretical framework of creativity in education is essential for developing effective interactive methods aimed at enhancing the creative capacities of students in agricultural education. A comprehensive theoretical approach posits that creativity is not merely an innate talent but a skill that can be cultivated through structured educational practices. This perspective aligns with the evolving nature of cultural interactions in a globalized world, where the diffusion of ideas across boundaries can inspire innovative approaches in teaching and learning ((İlhanÖren, 2023)). Moreover, the intersection of strategy

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and complexity in education emphasizes the need for adaptive frameworks that address diverse learning environments. These frameworks highlight the importance of experiential learning opportunities that facilitate student engagement and knowledge retention. Consequently, by integrating gamification techniques and culturally relevant educational strategies, educators can nurture creative problem-solving skills, ultimately preparing students for complex challenges in the agricultural sector ((Wigboldus et al., 2009)).

Over the centuries, educational paradigms surrounding creativity have evolved significantly, reflecting broader societal changes and an increasing recognition of creativitys integral role in learning. Early 20th-century thinkers like John Dewey emphasized experiential learning and the importance of fostering creative thinking skills, laying the groundwork for modern educational practices that prioritize innovative pedagogy. As curricula expanded to incorporate interdisciplinary approaches, the potential for creativity to solve complex problems emerged as a crucial educational outcome. By the late 20th century, the emphasis on creativity swelled, with the emergence of specialized programs that aimed to nurture creative potential, specifically in fields such as agricultural education. The implementation of interactive methods, as outlined in the Systems Education Matrix (SEM), serves as a contemporary response to historical insights by providing frameworks that promote creativity through collaborative and systems-oriented curricula (Bosch et al., 2009). Ultimately, recognizing these historical perspectives enables educators to design responsive and relevant instructional strategies that enhance creativity among students.

Understanding creativity within agricultural education requires a multidimensional approach that incorporates various theoretical frameworks. Theories of creativity emphasize the significance of user innovation, especially as related to farmers who intuitively develop practical solutions to enhance farm viability and efficiency. For instance, research highlights that Irish farmers often engage in innovative practices, utilizing tacit knowledge and practical skills to invent processes that reduce inefficiencies ((High et al., 2018)). These inventive processes align with broader principles of creativity, suggesting that agricultural education should extend beyond traditional curricular approaches to include experiential and collaborative learning. Moreover, theories positing that diverse perspectives contribute to innovation can enhance agricultural education by fostering environments where students actively engage with community stakeholders and land managers, thereby co-creating knowledge ((Howard et al., 2014)). Ultimately, recognizing the value of these theoretical insights can lead to the implementation of interactive methods that significantly enhance the creativity of students in the agricultural sector.

Fostering creativity in students, particularly in the field of agricultural education, significantly benefits from the implementation of interactive learning methodologies. These approaches encourage active engagement, allowing students to explore concepts hands-on, which enhances their ability to think critically and creatively. For instance, collaborative projects might involve students analyzing different factors that influence crop yield, thereby marrying theoretical knowledge with practical application. As seen in studies of hybrid models, such as in the case of colorectal cancer predictions, innovative methods that incorporate technology can reveal significant insights and patterns that trigger creative problem-solving. Additionally, the integration of platforms like Google Classroom and YouTube in the teaching process promotes an environment where students can experiment with ideas freely, fostering a culture of exploration and innovation ((Amalia et al., 2023)). By transforming traditional educational practices into interactive experiences, we create not just knowledgeable individuals, but creative thinkers capable of addressing contemporary challenges in agriculture and beyond.

Creativity, often viewed as a spontaneous and innate process, is significantly shaped by various psychological factors. Empirical research suggests that an individual’s cognitive flexibility, motivation, and emotional resilience play crucial roles in fostering creative thought. Specifically, intrinsic motivation—the drive to engage in a task for its own sake—can enhance creative performance, while extrinsic pressures might stifle innovation. Furthermore, environments that encourage professional dialogue, as outlined in (Garcia et al.), allow students to develop critical thinking and argumentation skills essential for creativity in agricultural education. Such environments not only foster collaboration but also enable students to navigate complex problems through creative solutions. Additionally, the ability to cluster relevant information, as demonstrated in advanced modeling techniques described in (Ismail et al., 2019), can aid in generating new

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ideas by revealing patterns that may not be readily apparent. Thus, understanding and cultivating these psychological factors are pivotal in enhancing creativity among students in agricultural disciplines.

In educational environments, particularly those focused on agricultural education, the assessment of creativity remains a multifaceted challenge, necessitating innovative approaches to evaluation. Traditional assessment methods often fail to capture the nuanced expressions of creativity, which are essential for students tasked with solving complex agricultural problems. As highlighted in recent studies, effective assessment should leverage interactive methods that not only encourage creative thinking but also measure it in contextually relevant ways. For instance, incorporating practical involvement and collaborative projects has been shown to significantly enhance students' artistic and innovative capabilities ((Amoh-Yaboah et al., 2023)). Moreover, the integration of technology can provide diverse platforms for students to express their creativity, making it imperative that educators develop robust assessment frameworks that accommodate these dynamics. Ultimately, embracing creative assessment strategies will not only support the students' artistic development but also ensure their preparedness for diverse careers in the evolving landscape of agriculture.

Assessing creativity within agricultural education presents significant challenges that complicate both teaching methodologies and evaluative frameworks. The inherently subjective nature of creativity makes it difficult to establish standardized metrics that can quantify innovative thinking. Researchers often struggle with aligning creativity assessment to traditional educational benchmarks, which tend to prioritize rote learning over dynamic problem-solving abilities. Reflecting on the insights gathered from educational literature, including the production of scholarly research noted in (ILR School et al., 2014), it becomes evident that an interdisciplinary approach could enrich evaluation strategies by incorporating diverse perspectives on creativity. Moreover, the nascent field of Animal-Computer Interaction (ACI) discussed in (Bastian et al., 2017) suggests that emerging technologies and interactive methods could serve as novel tools for fostering creativity in agricultural education. By bridging these methodologies, educators can potentially create an environment that not only nurtures creativity but also yields meaningful assessments of students innovative outputs.

Interactive Methods in Agricultural Education

Innovative approaches in agricultural education are essential for cultivating students creativity and enhancing their engagement with complex material. By integrating interactive methods, educators can create immersive learning experiences that facilitate a deeper understanding of agricultural concepts. For instance, utilizing visual storytelling and technology, such as digital comics or interactive applications, allows students to explore intricate philosophical topics while connecting them to real-world agricultural practices (Kotsis et al., 2024). Such methods not only make learning more relatable but also foster collaboration among students, enabling them to share insights and cultivate collective problem-solving skills. Furthermore, as illustrated in educational frameworks, the incorporation of interactive elements—whether through hands-on projects or digital platforms—plays a pivotal role in demystifying abstract ideas and encouraging innovative thinking (Rockefeller Foundation, 2000). Ultimately, integrating these interactive methods into the curriculum can significantly enrich the educational landscape and empower future leaders in agriculture.

Interactive methods in educational settings emphasize engagement and collaboration among learners, which significantly enhances the quality of creativity among students, particularly in agricultural education. These methods can be classified into various types, including collaborative learning, project-based learning, and experiential learning, each fostering a unique learning environment. Collaborative learning encourages students to work in teams, thereby enhancing problem-solving skills and innovative thinking, which are crucial in agricultural contexts where teamwork is often necessary (Davis et al.). Project-based learning, on the other hand, immerses students in real-world challenges, encouraging them to apply theoretical knowledge to practical situations. Additionally, experiential learning, through hands-on activities and fieldwork, bridges the gap between theory and practice, allowing students to internalize concepts more effectively while cultivating their creative capacities (Gorokhova et al., 2022). Together, these interactive methods not only improve student engagement but also contribute to a more dynamic and responsive educational framework in the field of agricultural education.

Case studies of successful interactive methods

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Successful interactive methods in agricultural education have demonstrated a profound impact on fostering student creativity. For instance, case studies reveal that participatory learning approaches, which encourage collaboration among students and faculty, can significantly enhance critical thinking and problem-solving skills. These collaborative frameworks often incorporate real-world challenges related to agricultural practices, enabling students to engage deeply with the material. As outlined in (Garforth et al., 2010), addressing complex 21st-century challenges such as climate change and food security through innovative extension theory emphasizes the need for diverse perspectives. Furthermore, cases where students participate in innovation systems and platforms show that building social capital and collective action leads to effective learning outcomes. Such interactive methods empower students to take ownership of their educational experience, fostering an environment where creativity thrives, ultimately preparing them for future challenges in the agricultural sector as informed practitioners.

Innovative approaches to education, particularly in agricultural studies, are increasingly relying on technology-enhanced interactive learning tools to foster creativity among students. These tools not only provide rich visual and interactive experiences but also enable students to engage with crucial concepts more deeply. For instance, mobile learning platforms and educational games have demonstrated significant efficacy in enhancing understanding of complex subjects, as evidenced by research showing a 35% improvement in students' ability to classify and differentiate geometric solids through game-based learning (Leitão et al., 2018). Similarly, the use of tablets for creating educational comics illustrates how visual storytelling can simplify abstract ideas and stimulate collaborative learning. Such interactive tools not only invigorate the learning process but also facilitate a multidimensional understanding of agricultural concepts by linking theoretical knowledge with practical applications, ultimately nurturing a more innovative and ecologically-minded cadre of future agricultural professionals (Kotsis et al., 2024).

A pivotal aspect of enhancing creativity in agricultural education lies in the implementation of collaborative learning strategies. Such approaches not only empower students to engage actively in the learning process but also foster the development of critical thinking and problem-solving skills essential for addressing real-world agricultural challenges. By adopting methods that emphasize teamwork and co-creation, educators can cultivate an environment where students learn from each other's diverse perspectives and experiences. Previous research highlights that problem-based learning and group projects significantly contribute to higher retention and comprehension of course material, as students participate in shared inquiry and exploration ((Alves et al., 2022)). Furthermore, integrating collaborative efforts with technology, as discussed in the performing arts education context, can deepen student engagement and enhance creative outputs, thereby preparing them for a variety of professional opportunities within the agricultural sector ((Amoh-Yaboah et al., 2023)). Overall, fostering collaboration equips students with the necessary skills to innovate and adapt in an evolving industry.

Experiential learning plays a pivotal role in reshaping agricultural education by fostering practical skills and critical thinking among students. As agricultural practices evolve with advancements in technology and sustainability, traditional educational paradigms must integrate hands-on experiences that reflect real-world challenges. This approach allows students to engage directly with dynamic agricultural systems, enabling them to develop innovative solutions to complex problems. For instance, the rise of Interactive, Connected, and Smart (ICS) materials highlights the increasing integration of technology in agriculture, necessitating educators to embrace experiential methodologies that ground theoretical knowledge in tangible experiences (Parisi et al., 2018). Similarly, the necessity for graduates to possess diverse entrepreneurial competencies reinforces the need for applied learning techniques that nurture creativity and adaptability in a rapidly changing field (Ilnitskaya et al., 2018). Ultimately, experiential learning not only enhances students academic development but also equips them with the essential skills required for future success in the agricultural sector.

Engaging students through fieldwork and practical experiences is essential for fostering creativity in agricultural education. Such experiences bridge the gap between theoretical knowledge and applied practice, allowing students to develop a deeper understanding of ecological systems and agricultural methods. Through resource-based teaching strategies, educators can enhance these experiences by utilizing local ecosystems and interactive materials that promote hands-on learning. For instance, (Mahambehlala et al., 2019) emphasizes the importance of Life Sciences educators employing various teaching aids, practical

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work, and resource persons to mediate the curriculum effectively. By establishing connections between classroom learning and real-world applications, students can cultivate critical thinking skills and engage in innovative problem-solving. Furthermore, a holistic approach, as suggested in (Lane et al., 2017), integrates various competency frameworks that prioritize both technical and systems-thinking abilities, ensuring that students not only acquire knowledge but also learn how to apply it creatively in dynamic agricultural contexts.

Impact of Interactive Methods on Student Creativity

Interactive methods significantly influence the cultivation of student creativity, particularly in agricultural education, where innovative thinking is crucial for problem-solving and adapting to evolving challenges. By engaging students through collaborative projects, discussions, and hands-on activities, these methods foster an environment that encourages exploration and experimentation. Such an engaging pedagogy draws parallels to strategies employed in other fields where the adoption of interactive frameworks has led to enhanced creativity and performance outcomes, as seen in studies that illustrate the effectiveness of fuzzy logic control in optimizing induction motor performance (Bohari et al., 2017). Similarly, the integration of hybrid models in predicting cancer tumor size underscores the importance of diverse methodologies in enhancing analytical capabilities (Ismail et al., 2019). Ultimately, the impact of interactive approaches transcends traditional learning, enabling students to connect theoretical knowledge with practical applications, thus enriching their creative capabilities within agricultural practices.

A thorough examination of creativity outcomes in educational settings reveals the significant impact of structured interactive methods on enhancing student ingenuity, particularly in agricultural education. Empirical studies have highlighted that practical involvement and collaborative projects foster critical thinking and creative problem-solving skills among students, thereby promoting innovation in agricultural practices. For instance, research indicates that methods such as hands-on learning and technology incorporation not only engage students but also enable them to apply theoretical knowledge in real-world contexts. The necessity for these pedagogical approaches is underscored by findings indicating that cultural awareness and exposure to diverse perspectives can lead to more holistic growth in creativity ((Amoh-Yaboah et al., 2023)). As globalization continues to influence educational paradigms, institutions must evaluate and adapt their strategies to embrace experiential learning, thus ensuring that graduates possess the creative abilities necessary to thrive in the evolving agricultural sector ((İlhanÖren, 2023)).

Understanding the dynamics of student engagement and motivation levels is pivotal for enhancing creativity in agricultural education. The effective integration of interactive methods can significantly bridge the gap between theoretical instruction and practical application, fostering a more vibrant learning environment. As noted, practical involvement, collaborative endeavors, the integration of innovative technologies are essential for student engagement, indicating that hands-on experiences are crucial for cultivating intrinsic motivation (Amoh-Yaboah et al., 2023). For instance, utilizing tools like iPads for creating educational comics can transform complex agricultural concepts into accessible narratives, thus stimulating interest and fostering deeper understanding among K–10 students (Kotsis et al., 2024). Such innovative strategies not only enhance motivation but also encourage students to actively participate in their education, which is vital for their future roles in the agricultural sector. Ultimately, sustaining high levels of engagement is necessary for nurturing creativity, ensuring that students are well-prepared for the challenges of the industry.

In the contemporary educational landscape, fostering critical thinking skills among students, particularly in agricultural education, is paramount to their success in an increasingly complex world. The integration of interactive methods, such as the development of instructional comics on philosophical themes, exemplifies innovative approaches that enhance comprehension and engagement among learners. As noted in (Kotsis et al., 2024), employing visual and narrative elements can demystify abstract concepts and create connections between real-world applications and theoretical content. Furthermore, the Merdeka Belajar initiative highlights a shift towards student-centered learning which cultivates essential skills such as creativity and problem-solving (Hunaepi et al., 2024). By incorporating collaborative projects and multifaceted educational practices, agricultural education can effectively promote critical thinking, enabling students to analyze information critically and develop innovative solutions to real-world challenges. Ultimately, these pedagogical advancements not only foster deeper ecological awareness but also prepare students to navigate and contribute to their fields with confidence and creativity.

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Educational experiences significantly shape students problem-solving abilities within agricultural education. Research indicates that low motivation and insufficient self-regulation can impede the development of critical thinking, which is essential for effective problem-solving ((Bekbayeva et al., 2022)). By incorporating interactive methods such as differentiated learning, educators can create an environment that aligns with the varying levels of student motivation and self-discipline, fostering a culture of critical engagement. Moreover, findings from critical thinking assessments reveal that students problem-solving skills vary widely, with only certain areas showing proficiency compared to national norms ((Paulsen et al., 2014)). This discrepancy suggests that targeted interventions are necessary to enhance critical thinking across the curriculum. Therefore, by adopting strategies that not only recognize individual differences but also promote collaboration and active learning, agricultural education programs can significantly improve students problem-solving capacities, leading to innovative solutions in real-world contexts.

The trajectory of career readiness is deeply influenced by the integration of interactive methods in educational settings, particularly in specialized fields like agricultural education. The employment landscape increasingly values a robust set of competencies, with 21st-century skills—such as critical thinking, collaborative communication, and digital literacy—being paramount for future success (Kulman et al., 2014). Interactive methods, including gamified learning experiences, cultivate these skills by fostering problem-solving abilities and encouraging cognitive flexibility. Moreover, a study highlighted that discrepancies in perceptions of essential employability skills exist among key stakeholders, indicating a need for a unified approach to prepare students effectively (Alamil et al., 2022). This alignment of academic efforts with industry expectations is critical, as graduates who engage in reflective learning experiences and actively hone their soft skills tend to navigate career transitions more successfully. Thus, the long-term effects on career readiness can be substantially enhanced through the intentional implementation of innovative educational methodologies.

Feedback from both students and educators plays a pivotal role in refining interactive methods essential for fostering creativity in agricultural education. Engaging with students perspectives allows educators to tailor learning experiences that resonate with their unique preferences and cognitive processes. As highlighted in contemporary research, understanding the varying characteristics and learning styles of younger cohorts can significantly enhance pedagogical approaches (Larson et al., 2024). Moreover, when educators actively solicit and incorporate feedback from students regarding the effectiveness of specific interactive strategies, they facilitate a collaborative educational environment that encourages innovation and creativity. This reciprocal dialogue not only boosts student engagement but also allows teachers to adjust their instructional methods to better meet learners needs, particularly in fields requiring applied creativity, such as agriculture. Ultimately, a structured framework for gathering and analyzing feedback is crucial in continually improving the quality of educational practices and fostering an atmosphere of creative exploration (Kotsis et al., 2024).

Best Practices for Implementing Interactive Methods

The successful implementation of interactive methods in agricultural education relies on pedagogical strategies that engage students actively in the learning process. Incorporating hands-on learning experiences can significantly amplify creativity, allowing students to explore practical applications of theoretical concepts. For instance, strategies such as collaborative projects and group discussions foster a deep understanding of agricultural principles while stimulating innovative thinking. Furthermore, leveraging technology can enhance these interactive experiences, bridging the gap between traditional methods and modern learning environments. Research indicates that the involvement of guest speakers, especially experienced professionals from the agricultural sector, helps contextualize lessons and exposes students to diverse perspectives and real-world challenges (Amoh-Yaboah et al., 2023). Additionally, cultivating an environment that encourages experimentation and risk-taking is essential for nurturing creativity (Rockefeller Foundation, 2000). Ultimately, these best practices culminate in a holistic educational approach that not only enriches students learning experiences but also prepares them for future careers in a rapidly evolving agricultural landscape.

An effective curriculum design for interactive learning necessitates a holistic approach that emphasizes student engagement and critical thinking. Such a curriculum should integrate active learning methodologies that promote exploration and collaboration among students, particularly in agricultural education where practical application is vital. The Merdeka Belajar initiative exemplifies this approach, emphasizing the

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development of 21st-century skills and students autonomy, ultimately fostering creativity and problem-solving abilities ((Hunaepi et al., 2024)). Moreover, incorporating flipped classrooms and problem-based learning, as indicated in recent research, encourages students to take ownership of their learning processes and engage more deeply with the subject matter ((Alves et al., 2022)). By addressing potential challenges—such as teacher preparedness and resource availability—curriculum designers can enhance the effectiveness of interactive learning environments. Ultimately, a well-structured curriculum that prioritizes these elements can significantly improve the quality of creativity and learning outcomes for students in agricultural education.

Effective training of educators in interactive techniques is essential for fostering an engaging learning environment that promotes creativity among students in agricultural education. By incorporating methods that prioritize collaboration, critical thinking, and real-world problem-solving, educators can better equip students to navigate complex agricultural challenges. For instance, programs like TESSA have demonstrated the importance of school-based training and the development of Open Educational Resources, which empower teachers to utilize innovative pedagogical approaches in their classrooms (Wolfenden et al., 2008). Similarly, the increasing emphasis on entrepreneurship education highlights the necessity of integrating interactive methods that encourage students to take initiative and explore entrepreneurial opportunities within the agricultural sector (Biemans et al.). Such training not only enhances educators teaching strategies but also directly contributes to cultivating a culture of creativity and innovation among students, ultimately leading to improved outcomes in both education and industry practices.

In cultivating a supportive learning environment, it is essential to consider the unique needs and characteristics of students, especially in specialized fields like agricultural education. A supportive atmosphere not only fosters creativity but also enhances students' engagement and retention of knowledge. Interactive methods, such as collaborative projects and hands-on learning experiences, create opportunities for students to apply theoretical concepts in practical settings, ultimately enriching their educational journey. Moreover, as highlighted in (Larson et al., 2024), understanding the specific learning preferences of Generation Z can significantly influence the approaches educators take, allowing for personalized instruction that resonates with this cohort. Such strategies cultivate an empowering environment where students feel valued and motivated to explore their creativity, leading to improved learning outcomes. This critical engagement further reinforces the importance of creating an inclusive and adaptive environment, ensuring that students are well-equipped for the challenges of the modern agricultural landscape, as supported by findings in (Bohari et al., 2017).

Effective agricultural education necessitates a multifaceted approach that actively incorporates community resources and partnerships to enhance student creativity. Establishing connections with local agricultural stakeholders, including farmers, extension services, and agribusiness professionals, can provide students with invaluable real-world insights and experiential learning opportunities. Such collaborations enable students to engage with the complexities of agricultural practices and risk management, aligning with the objectives outlined in integrated education initiatives. For instance, the 1996 Federal Agricultural Improvement and Reform Act emphasized the importance of risk management education, suggesting that partnerships are crucial for disseminating knowledge about contemporary challenges in agriculture (Jose et al.). Moreover, a structured engagement with community resources not only enriches the learning experience but also prepares students to navigate the landscape of modern agriculture, fostering innovative thinking by grounding theoretical concepts in practice. Ultimately, these partnerships cultivate a symbiotic relationship that benefits both the educational institution and the surrounding agricultural community.

Evaluating the effectiveness of interactive methods

The incorporation of interactive methods in agricultural education has emerged as a pivotal strategy to enhance student creativity and autonomy. Recent studies indicate that these methods foster an engaging learning environment, thereby encouraging active participation and critical thinking among students. For instance, scaffolding techniques paired with problem-based learning have demonstrated significant improvements in learning outcomes, as they allow learners to tackle real-world challenges within their field (Abdullah et al., 2023). Furthermore, by utilizing multimedia elements such as videos and images, educators can create dynamic learning resources that not only enhance comprehension but also stimulate creativity in students problem-solving approaches. As the ILR Schools research shows, effective utilization of diverse

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pedagogical strategies can lead to a robust academic output, emphasizing that the quality of interaction directly correlates with student independence and innovation (ILR School et al., 2014). Thus, evaluating these interactive methods through systematic research is essential for advancing agricultural education and enhancing the creative capacities of future practitioners.

Fostering an environment that encourages continuous improvement in agricultural education is essential for cultivating innovative thinkers. One effective strategy involves integrating critical thinking assessments into the curriculum, as demonstrated by the findings of a recent study where senior-level undergraduates showed significant strengths in summarizing results from graphs, thus illuminating their analytical capabilities in practical scenarios (Paulsen et al., 2014). Furthermore, the adoption of interactive learning technologies, such as mobile-based games designed to enhance geometrical understanding, illustrates a paradigm shift in teaching methods that can significantly bolster student engagement and knowledge retention (Leitão et al., 2018). These interactive approaches not only facilitate real-time feedback but also promote collaborative problem-solving skills that are vital for future agricultural educators. By combining targeted assessments with engaging technological tools, institutions can create a robust framework that supports ongoing development and creativity among students, ultimately leading to a more proficient workforce in the agricultural sector.

Conclusion

In conclusion, the implementation of interactive teaching methods has proven essential in enhancing the creative capacities of students within agricultural education. By shifting the focus from traditional theoretical frameworks to applied, professionally oriented training, students are better equipped to engage with real-world challenges encountered in their field. As demonstrated, the formation of professional competence through innovative pedagogical approaches significantly improves both knowledge retention and readiness for practical application in agricultural contexts (Oksana Bulgakova et al., 2023, p. 661-663). Moreover, research supports that these interactive strategies not only foster critical thinking but also promote heightened engagement and satisfaction among students, leading to sustained academic achievements (ChalardChantarasombat et al., 2022, p. 36). This multifaceted approach ultimately cultivates a more skilled and adaptable workforce, one that is prepared to tackle the complex demands of modern agriculture. Future research should continue to explore the effects of these methods to refine and expand upon this critical pedagogical shift.

Summary of key findings

The implementation of interactive methods in agricultural education has yielded significant insights into enhancing student creativity. Notably, the findings indicate that tools such as Google Classroom and YouTube, as referenced in research on E-Learning, play a crucial role in facilitating dynamic learning environments relevant to todays digital landscape (Amalia et al., 2023). Educators have effectively integrated these platforms into their teaching strategies, embracing a tripartite approach encompassing planning, execution, and evaluation of lessons. This structured methodology has been linked to improved engagement and creativity among students, as they navigate core activities that encourage collaborative and innovative thinking. However, challenges persist, including technological resource limitations and difficulties in student assessment, which can hinder the effectiveness of these methods (Amalia et al., 2023). Furthermore, broader insights from educational frameworks highlight the necessity for continuous professional development for educators, enabling them to adeptly handle distractions and foster meaningful social interactions within digital learning spaces.

Implications for agricultural education

The evolving landscape of agricultural education necessitates a paradigm shift towards cultivating creativity and innovation among students. Traditional pedagogical approaches may no longer suffice in the face of contemporary challenges such as climate change and food security (Garforth et al., 2010). As agricultural educators, there is a pressing responsibility to incorporate interactive methods that not only engage students but also enhance their problem-solving abilities and resourcefulness. This emphasis on creativity aligns with the development of innovation systems, recognizing that meaningful learning occurs when students actively partake in collaborative and experiential learning environments. Moreover, the inclusion of social learning concepts, such as collective action and social capital, can empower students to navigate complex agricultural challenges effectively. Ultimately, by embracing these interactive strategies, agricultural education can

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better prepare future professionals to contribute meaningfully to sustainable practices and rural development in an increasingly dynamic and interconnected world (Rockefeller Foundation, 2000).

Recommendations for educators and policymakers

To enhance the creative capacities of students in agricultural education, it is imperative for educators and policymakers to adopt a multifaceted approach that emphasizes stakeholder engagement and innovative pedagogical strategies. First and foremost, actively involving community members and industry stakeholders in program development can ensure that curricula align with real-world needs and labor market demands. This notion resonates with recent findings underscoring the importance of identifying stakeholder needs as a foundational step in educational programming (Kendall M. Wright et al.). Furthermore, educators should be encouraged to implement interactive teaching methods that promote creativity, such as project-based learning and collaborative problem-solving exercises. These methods not only engage students but also foster critical thinking skills essential for the agricultural sector. Additionally, investment in technological resources is crucial, as it supports the development of digital competencies and enhances overall educational outcomes (MiroslavaTokovska et al., 2022, p. 150-151). By prioritizing these recommendations, educational institutions can cultivate a more innovative and responsive agricultural education framework.

Future research directions

As educational landscapes evolve, it is imperative to explore innovative avenues for enhancing the creative capacities of students in agricultural education. Future research should delve into the integration of augmented reality (AR) and artificial intelligence (AI) technologies as tools for fostering interactive learning environments. Studies focusing on the specific applications of AR in agricultural contexts could identify how immersive experiences lead to heightened engagement and creativity among learners, which is critical given the demand for innovative solutions in this field (2024). Furthermore, examining AI-human collaboration presents a promising direction, as AIs data-driven insights can personalize educational experiences while educators emphasize critical thinking and creativity (WatcharapornJantanukul, 2024). This dual approach could provide a comprehensive understanding of effective pedagogical strategies, ensuring that the integration of such technologies is equitable and ethically sound. Ultimately, these investigations are vital for shaping future educational practices that elevate creativity in agricultural education.

Final thoughts on creativity in agriculture

In reflecting upon the role of creativity in agricultural education, one must recognize its pivotal significance for fostering sustainable practices and innovative solutions within the sector. As evidenced by research examining experiential learning environments, the integration of creative processes enhances students' abilities to address complex problems through participatory methodologies, such as the Rapid Situation Analysis developed for tourism in Ghana (Koutra et al., 2010). This approach not only empowers students to analyze corporate social responsibility and sustainable development but also cultivates critical thinking and problem-solving skills essential for contemporary agriculture. Additionally, findings from studies on creativity models demonstrate that creative behaviors—encompassing aspects like problem awareness, divergent and convergent thinking, and adaptability—are crucial for cultivating the next generation of agricultural leaders (Aboukinane et al., 2009). Thus, prioritizing interactive and experiential teaching methods can significantly augment the quality of creativity among students, ultimately leading to more resilient and innovative agricultural practices.

Call to action for adopting interactive methods

The implementation of interactive methods in agricultural education is not merely an enhancement to existing pedagogical practices; it represents a fundamental shift toward fostering a more engaging and effective learning environment. Traditional instructional approaches often neglect the complexities of creative thinking required in agriculture, leaving students ill-equipped to handle real-world challenges. By integrating interactive techniques—such as hands-on projects, collaborative learning experiences, and technological simulations—we can cultivate an atmosphere that prioritizes innovation and critical problem solving. These methodologies not only encourage student participation but also promote deeper understanding through experiential learning. As evidence mounts regarding the efficacy of interactive education, it becomes imperative that institutions adopt such strategies systematically. Embracing these

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methods equips students with the necessary skills to navigate and contribute to the rapidly evolving landscape of agriculture, ultimately enhancing their creative capacities and ensuring their preparedness for future challenges in the field.

References

1. Wolfenden, F. "The TESSA OER Experience: Building sustainable models of production and user implementation" 'Ubiquity Press, Ltd.', 2008.
2. Biemans, H.J.A., Chizari, M., Karimi, S., Mulder, M. "Entrepreneurship Education in Iranian Higher Education: The Current State and Challenges"
3. Ismail, Shuhaida, Kamardan, Muhamad Ghazali, Rusiman, MohdSaifullah, Shafi, Muhammad Ammar "A hybrid of multiple linear regression clustering model with support vector machine for colorectal cancer tumor size prediction" 'The Science and Information Organization', 2019.
4. Amalia, Rizky, Mulyadi, Mulyadi, Tahrun, Tahrun "THE IMPLEMENTATION OF E-LEARNING IN TEACHING ENGLISH AT SMP NEGERI 1 OF BANYUASIN III" Universitas PGRI Palembang, 2023.
5. Paulsen, Thomas, Perry, Dustin, Retallick, Michael, Retallick, Michael "A Critical Thinking Benchmark for a Department of Agricultural Education and Studies" Iowa State University Digital Repository, 2014.
6. Leitão, Rui, Marcos, Adérito, Rodrigues, Joao M. F. "Mobile learning: benefits of augmented reality in geometry teaching" 'IGI Global', 2018.
7. "Rockefeller Foundation - 1999 Annual Report" Rockefeller Foundation, 2000.
8. Bosch, Ockie, Drack, Manfred, Horiuchi, Yoshihide, Jones, Jed, Ramage, Magnus "On the design of systems-oriented university curricula" 2009.
9. ILR School, Cornell University "ILR Research in Progress 2013-14" DigitalCommons@ILR, 2014.
10. Bastian, Boesch, Caffrey, Carlson, Cheok, Clara Mancini, Gulliksen, Hall, Jackson, Kirksey, Lawson, Lee, Mancini, Mancini, Mancini, Millar, Morton, Muller, North, Oskar Juhlin, Philo, Pons, Reiss, Resner, Robinson, Rossing, Samuel, Shaun Lawson, Skinner, Väätäjä, Väätäjä, Weilenmann, Whiten, Wirman, Wirman "Animal-Computer Interaction: the emergence of a discipline" 'Elsevier BV', 2017.
11. Garcia, Philip, Nelson, Carl H. "ENGAGING STUDENTS IN RESEARCH: THE USE OF STRUCTURED PROFESSIONAL DIALOGUE"
12. Ismail, Shuhaida, Kamardan, Muhamad Ghazali, Rusiman, MohdSaifullah, Shafi, Muhammad Ammar "A hybrid of multiple linear regression clustering model with support vector machine for colorectal cancer tumor size prediction" 'The Science and Information Organization', 2019.
13. Amoh-Yaboah, Richmond, Arkhurst, Kow, Dzakey, Francis Afenyo "Exploring Effective Methods of Teaching Performing Arts Courses in Ghanaian Colleges of Education" The International Institute for Science, Technology and Education (IISTE), 2023.
14. Kotsis, Konstantinos, Tsiouri, Eleftheria "Using iPad Making Comics for Teaching the “Fire and the Cave Men” for K-10 Students" European Institute of Knowledge and Innovation, 2024.
15. Long, Ada "Editor\u27s Introduction [Volume19]" DigitalCommons@University of Nebraska - Lincoln, 2023.
16. "Rockefeller Foundation - 1999 Annual Report" Rockefeller Foundation, 2000.
17. Bekbayeva, Zhanar S., Bolshakov, Aleksandr A., Chechetkina, Nina V., Solovyev, Alexander N., Sosina, Liudmila V. "Problems of Organizing Critical Thinking Training for University Students" North American Business Press, 2022.
18. Paulsen, Thomas, Perry, Dustin, Retallick, Michael, Retallick, Michael "A Critical Thinking Benchmark for a Department of Agricultural Education and Studies" Iowa State University Digital Repository, 2014.
19. High, Chris, Lane, Andy, Macken-Walsh, Áine, O'Flynn, Trish "Farmers doing it for themselves: how farmer-inventors are frustrated by their interactions with the Agricultural Knowledge and Innovation System" International Farming Systems Assocaition, 2018.

ISSN NO: 2771-8840
November 2024

20. Mahambehlala, Sindile. "Exploring Life Sciences educators' enactment of resource-based teaching in three rural secondary schools in South Africa." 2019.
21. Lane, Andy "The systemic implications of constructive alignment of higher education level learning outcomes and employer or professional body based competency frameworks" EADTU, 2017.
22. Garforth, Chris "Adapting to new challenges: extension theory and practice for the 21st century" 2010.
23. 1.Barrera C., Castello M. L., Dalla Rosa M., Heredia A., Hobley T. J., Knobl C. F., Materia V. C., Romanova G., Russo S., Segui L., Viaggi D., Viereck N., Xu S. M. "Education for innovation and entrepreneurship in the food system: the Erasmus+ BoostEdu approach and results" 2021.
24. 2.Amoh-Yaboah, Richmond, Arkhurst, Kow, Dzakey, Francis Afenyo "Exploring Effective Methods of Teaching Performing Arts Courses in Ghanaian Colleges of Education" The International Institute for Science, Technology and Education (IISTE), 2023.
25. 3.İlhan Ören "Transmission of the Values of Solidarity and Unity in Turkish Societal Culture to Corporate Cultural Structure Through Gamification" International Journal of Innovative Approaches in Education, 2023.
26. Joao M. F. "Mobile learning: benefits of augmented reality in geometry teaching" 'IGI Global', 2018.
27. 4..Kotsis, Konstantinos, Tsiouri, Eleftheria "Using iPad Making Comics for Teaching the "Fire and the Cave Men" for K-10 Students" European Institute of Knowledge and Innovation, 2024.
28. 5.Garcia, Philip, Nelson, Carl H. "ENGAGING STUDENTS IN RESEARCH: THE USE OF STRUCTURED PROFESSIONAL DIALOGUE"
29. 7.Слатвінська, О.А. "Використаннятехнологіїімітаційно-ігровогонавчання у учнів ПТНЗ аграрного профілю" Scientific world, Ivanovo, 2015.
30. 8.Kotsis, Konstantinos, Tsiouri, Eleftheria "Using iPad Making Comics for Teaching the "Fire and the Cave Men" for K-10 Students" European Institute of Knowledge and Innovation, 2024.
31. 9.Hunaepi, Hunaepi, Suharta, I GustiPutu "Transforming Education in Indonesia: The Impact and Challenges of the Merdeka Belajar Curriculum" Publishing Center Dialog, 2024.
32. 10.İlhan Ören "Transmission of the Values of Solidarity and Unity in Turkish Societal Culture to Corporate Cultural Structure Through Gamification" International Journal of Innovative Approaches in Education, 2023.
33. 11.Wigboldus, S.A. "A list of websites and reading materials on strategy & complexity" Wageningen UR Centre for Development Innovation, 2009.
34. 12.Koutra, Christina "Rapid Situation Analysis: a hybrid, multi-methods, qualitative, participatory approach to researching tourism development phenomena" 'Informa UK Limited', 2010.
35. 13.Aboukinane, Chehrazade "A qualitative study of creative thinking using experiential learning in an agricultural and life sciences course" 2009.
36. 14.Alves, Alaina, Reis, Alan, Wendland, Edson Cezar "METODOLOGIAS ATIVAS NO ENSINO SUPERIOR: UM MAPEAMENTO SISTEMÁTICO NO CONTEXTO DOS CURSOS DE ENGENHARIA" SciELO Preprints, 2022.
37. 15.Hunaepi, Hunaepi, Suharta, I GustiPutu "Transforming Education in Indonesia: The Impact and Challenges of the Merdeka Belajar Curriculum" Publishing Center Dialog, 2024.
38. 16.Ilnitskaya, T. O., Lucci, F., Pluzhnik, I. L., Ильницкая, Т. О., Луччи, Ф., Плужник, И. Л. "ARE ENTREPRENEURS BORN OR MADE? EFFECTIVE ACADEMIC MODELS TO FOSTER ENTREPRENEURIAL GRADUATES" 'Russian State Vocational Pedagogical University', 2018.
39. 17.Parisi, Stefano, Petrelli, Daniela, Rognoli, Valentina, Spallazzo, Davide "ICS Materials. Towards a re-Interpretation of material qualities through interactive, connected, and smart materials." 'DesignResearchSociety', 2018.
40. 18.ILR School, Cornell University "ILR Research in Progress 2013-14" DigitalCommons@ILR, 2014.
41. 19.Amoh-Yaboah, Richmond, Arkhurst, Kow, Dzakey, Francis Afenyo "Exploring Effective Methods of Teaching Performing Arts Courses in Ghanaian Colleges of Education" The International Institute for Science, Technology and Education (IISTE), 2023.

ISSN NO: 2771-8840
November 2024

42. 20.Bohari, Azuwien Aida, Hanafi, Dirman, Mat Ariff, Roslina, Muhammad Zin, Nooradzianie, MulyoUtomo, Wahyu, Sim, Sy Yi "Takagi-Sugeno fuzzy perpose as speed controller in indirect field oriented control of induction motor drive" 'Institute of Advanced Engineering and Science', 2017.
43. 21.Ismail, Shuhaida, Kamardan, Muhamad Ghazali, Rusiman, MohdSaifullah, Shafi, Muhammad Ammar "A hybrid of multiple linear regression clustering model with support vector machine for colorectal cancer tumor size prediction" 'The Science and Information Organization', 2019.
44. 22.ILR School, Cornell University "ILR Research in Progress 2013-14" DigitalCommons@ILR, 2014.
45. Abdullah, Dahlan, Aziz, Firman, Mahendika, Devin, Riniati, Wa Ode, Siregar, Juarni "The Role Of Pictures And Videos In The Learning Independence Of Elementary School Students" Departement of Mathematics Education, 2023.
46. 23.Alves, Alaina, Reis, Alan, Wendland, Edson Cezar "METODOLOGIAS ATIVAS NO ENSINO SUPERIOR: UM MAPEAMENTO SISTEMÁTICO NO CONTEXTO DOS CURSOS DE ENGENHARIA" SciELO Preprints, 2022.
47. 25.Amoh-Yaboah, Richmond, Arkhurst, Kow, Dzakey, Francis Afenyo "Exploring Effective Methods of Teaching Performing Arts Courses in Ghanaian Colleges of Education" The International Institute for Science, Technology and Education (IISTE), 2023.
48. 26.Davis, Kristin, Ekboir, Javier, Mekasha, Wendmsyamregne, Ochieng, Cosmas M.O., Spielman, David J., Zerfu, Elias "Strengthening agricultural education and training in Sub-Saharan Africa from an innovation systems perspective: Case studies of Ethiopia and Mozambique"
49. 27.Gorokhova , Anna M., Kuleshov, Aleksandr V., Novikova, Yevgeniya B., Skrypnyk, Nataliia S. "Extra-Curricular Activities as an Important Factor for Developing Subject Qualities of Future Engineers" North American Business Press, 2022.
50. 28.High, Chris, Lane, Andy, Macken-Walsh, Áine, O'Flynn, Trish "Farmers doing it for themselves: how farmer-inventors are frustrated by their interactions with the Agricultural Knowledge and Innovation System" International Farming Systems Assocaition, 2018.
51. 29."Rockefeller Foundation - 1999 Annual Report" Rockefeller Foundation, 2000.
52. 30.Kulman, Randy, Seitsinger, Roy, Slobuski, Teresa "Teaching 21st Century, Executive-Functioning, and Creativity Skills with Popular Video Games and Apps" SJSU ScholarWorks, 2014.
53. 31.Alamil, Luis, Daniel, Reuben M, Mainga, Wise "Perceptions of Employability Skills of Undergraduate Business Students in a Developing Country: An Exploratory Study" 'IUScholarWorks', 2022.
54. 32.Olga V. Nazarova, Svetlana P. Shmalko, Aleksey V. Nazarov, Nadezhda I. Sevryugina "Freeware Software in the Implementation of Interactive Educational Content" 2021.
55. 33.EssiRyymin, Laura Lamberg, AnnukkaPakarinen "How to Digitally Enhance Bioeconomy Collaboration: Multidisciplinary Research Team Ideation for Technology Innovation" Technology Innovation Management Review, 2020.
56. 34.MiroslavaTokovska, TímeaŠebenZaťková, ĽubicaJamborová "Digital Competencies Development in Higher Education Institutions: A Mixed Methods Research Study" Emerging Science Journal, 2022.
57. 35.Kendall M. Wright, Stacy K. Vincent, Andrew Hauser, Lucas D. Maxwell "Designing a Technique for Program Expansion of Secondary Agricultural Education"
58. 36.Oksana Bulgakova, LesyaZbaravska, IlmarsDukulis, AdolfsRucins "Content of Professionally Oriented Training in Course of Physics for Students of Agricultural Engineering Specialties" 2023.
59. 37.ChalardChantarasombat, ChaiyuthSirisuthi "Using the Development Module Learning of Leader Teacher in Creative Thinking for Enhancement the Doctor of Philosophy Program Educational Administration and Leadership" CADDO GAP Press USA, 2022.
60.