

DIDACTIC OPPORTUNITIES FOR DEVELOPING THE SCIENTIFIC RESEARCH COMPETENCIES OF PRE-SERVICE TEACHERS BASED ON A CREATIVE APPROACH

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Abstract: The development of scientific research competence is one of the primary objectives of modern teacher education. Preparing future teachers who can conduct educational research, solve pedagogical problems creatively, and apply scientific knowledge in professional practice has become increasingly important. This study examines the didactic opportunities for developing the scientific research competencies of pre-service teachers through a creative approach. A mixed-method research design was employed involving undergraduate teacher education students. Data were collected through questionnaires, classroom observations, interviews, and portfolio assessment. Creative instructional strategies, including inquiry-based learning, project-based learning, collaborative research, brainstorming, reflective practice, and digital learning technologies, were implemented during one academic semester. The findings indicate that creativity-oriented instruction significantly improves research motivation, critical thinking, information literacy, academic writing, collaboration, and independent inquiry skills. The study concludes that integrating creative pedagogical approaches into teacher education creates effective conditions for strengthening scientific research competence and preparing innovative, research-oriented teachers capable of addressing contemporary educational challenges.

Keywords: creative approach, scientific research competence, pre-service teachers, didactic opportunities, inquiry-based learning, teacher education, creativity, higher education.



Introduction

The rapid development of science, technology, and globalization has brought fundamental changes to educational systems worldwide. Higher education institutions are expected to prepare competitive specialists who possess not only professional knowledge but also research skills, creativity, critical thinking, and the ability to solve educational problems effectively. In this context, teacher education has become one of the most important areas of educational reform because teachers play a decisive role in improving the quality of education and promoting sustainable social development. Consequently, the development of scientific research competencies among pre-service teachers has become a strategic objective of modern higher education. Scientific research competence is regarded as an integrated professional competence that combines theoretical knowledge, methodological awareness, practical research skills, critical thinking, creativity, academic communication, digital literacy, and reflective practice. Future teachers who possess these competencies are able to identify educational problems, formulate research objectives, select appropriate research methods, analyze empirical evidence, interpret research findings, and implement evidence-based solutions in educational practice. Therefore, research competence contributes directly to professional effectiveness, innovation, and lifelong learning. Contemporary educational reforms emphasize the transition from knowledge-based education to competency-based education. Unlike traditional instructional models that primarily focus on memorization and reproduction of theoretical information, competency-based education encourages students to apply knowledge creatively in authentic professional situations. Within this educational paradigm, scientific research competence becomes one of the essential learning outcomes because it prepares future teachers to investigate educational challenges systematically and improve



instructional quality through scientific inquiry. One of the most promising approaches for developing research competence is the creative approach. Creativity enables students to generate original ideas, explore alternative perspectives, formulate innovative solutions, and respond flexibly to complex educational situations. A creativity-oriented learning environment encourages curiosity, intellectual independence, collaboration, experimentation, and reflective thinking. Such characteristics are closely connected with the nature of scientific research, where innovation, analytical reasoning, and evidence-based decision-making are fundamental requirements. Theoretical foundations of the creative approach can be found in constructivist learning theory, which considers learners as active participants in knowledge construction. According to this perspective, meaningful learning occurs when students investigate real problems, collaborate with peers, analyze information critically, and construct their own understanding through experience. Inquiry-based learning, project-based learning, problem-based learning, and collaborative learning are widely recognized as effective instructional strategies for implementing constructivist principles in higher education. These approaches provide authentic opportunities for students to participate in scientific investigations and strengthen their research competence. Digital transformation has also expanded the possibilities for research-oriented teacher education. Electronic scientific databases, online journals, digital libraries, statistical software, artificial intelligence applications, and collaborative virtual platforms have become indispensable resources for conducting educational research. Future teachers must therefore acquire advanced information literacy and digital research skills to access, evaluate, organize, and utilize scientific information effectively. The integration of digital technologies into creativity-oriented instruction creates an educational environment that supports independent learning, collaboration, and academic productivity. Despite considerable progress in educational innovation, many teacher education



institutions continue to rely heavily on traditional lecture-based instruction. Such instructional practices often provide limited opportunities for independent inquiry, critical reflection, collaborative investigation, and practical research experience. Consequently, many graduates experience difficulties in designing research projects, conducting literature reviews, analyzing educational data, writing academic papers, and applying research findings to professional practice. These challenges demonstrate the need to identify effective didactic opportunities that integrate creativity into research-oriented teacher education. Didactic opportunities refer to the instructional conditions, methods, educational technologies, learning resources, and organizational strategies that facilitate competency development. Creativity-oriented didactic opportunities include inquiry-based learning, project-based research, collaborative scientific investigation, brainstorming, reflective practice, academic discussions, peer assessment, digital educational technologies, and authentic assessment. These instructional strategies encourage active student participation and provide meaningful learning experiences that strengthen scientific research competence. Based on these considerations, the present study aims to examine the didactic opportunities for developing the scientific research competencies of pre-service teachers through a creative approach. Specifically, the study seeks to determine how creativity-oriented instructional strategies influence research motivation, critical thinking, information literacy, academic writing, collaboration, and independent scientific inquiry. The findings are expected to provide practical recommendations for improving teacher education programs and strengthening research-oriented professional preparation in higher education institutions.

Materials and Methods

This study employed a mixed-method research design to investigate the



effectiveness of a creative approach in developing the scientific research competencies of pre-service teachers. The combination of quantitative and qualitative methods provided comprehensive information about students' competency development and learning experiences.

The research was conducted during the 2025–2026 academic year at a higher education institution offering teacher education programs. A total of 120 undergraduate pre-service teachers voluntarily participated in the study. The participants were selected using purposive sampling and were divided into two equal groups: an experimental group (60 students) and a control group (60 students). Both groups studied the same course content; however, the experimental group received instruction through creativity-oriented teaching methods, while the control group followed conventional instructional practices. Several research instruments were employed to collect reliable data. A structured questionnaire measured students' scientific research competence before and after the instructional intervention. Classroom observation was conducted throughout the semester to evaluate students' participation, creativity, collaboration, and problem-solving abilities. Semi-structured interviews were organized with selected participants to identify their perceptions regarding creative learning and research activities. Students' research portfolios, reflective journals, project reports, and academic presentations were also analyzed to evaluate competency development. The instructional intervention lasted sixteen weeks. During this period, the experimental group participated in inquiry-based learning, project-based learning, brainstorming activities, collaborative scientific investigations, academic discussions, peer-review sessions, and reflective learning. Students independently identified educational problems, reviewed scientific literature, formulated research questions, designed research procedures, collected and analyzed data, and presented research findings. Digital educational technologies, including online scientific databases, electronic libraries, reference



management software, collaborative cloud platforms, and academic writing tools, were integrated into all research activities. The control group studied the same theoretical content using traditional lecture-based instruction and teacher-directed practical exercises. Although both groups completed identical learning objectives, only the experimental group was systematically engaged in creativity-oriented research activities. Quantitative data obtained from the questionnaires were analyzed using descriptive statistical methods, including percentages, mean scores, and comparative analysis of pre-test and post-test results. Qualitative information collected through interviews, classroom observations, and reflective journals was analyzed using thematic analysis to identify recurring patterns related to creativity, motivation, critical thinking, collaboration, and scientific inquiry. Ethical principles were strictly observed throughout the research process. Participation was voluntary, informed consent was obtained from all participants, and confidentiality of personal information was ensured. Students were informed that participation in the research would not influence their academic assessment. These ethical procedures enhanced the credibility and reliability of the study. The selected research methodology provided sufficient evidence to evaluate the didactic opportunities of a creative approach for strengthening the scientific research competencies of future teachers and allowed the researcher to compare learning outcomes between traditional and creativity-oriented instructional environments.

Results

The findings of the study revealed that the implementation of a creative approach had a positive impact on the development of the scientific research competencies of pre-service teachers. Comparative analysis of the pre-test and post-test results indicated that the experimental group demonstrated considerably higher improvement than the control group in all assessed competency indicators. At the beginning of the study, both groups showed similar levels of research competence,



indicating comparable academic backgrounds and research experience. However, after sixteen weeks of creativity-oriented instruction, the experimental group achieved significantly better results in research planning, literature review, data collection, analysis, interpretation, academic writing, and scientific presentation. The improvement confirmed the effectiveness of integrating creativity into teacher education.

One of the most notable outcomes was the increase in students' research motivation. Many participants reported that creative learning activities made scientific research more interesting and meaningful. Rather than considering research as a compulsory academic requirement, students began to perceive it as a practical tool for solving real educational problems. Their willingness to participate in conferences, prepare scientific papers, and continue research activities also increased. The findings further demonstrated significant improvement in critical thinking. Students became more capable of identifying educational problems, formulating relevant research questions, evaluating different viewpoints, and selecting appropriate research methods. Classroom observations showed that learners actively participated in discussions, defended their opinions with scientific evidence, and critically analyzed research findings. These changes reflected the positive influence of inquiry-based learning and collaborative investigation.

Academic writing skills also improved considerably during the intervention. Analysis of students' research reports indicated better organization of scientific papers, clearer presentation of ideas, more accurate use of academic language, and stronger integration of scholarly literature. Peer-review activities encouraged students to revise their work critically and improve the quality of their scientific writing. As a result, many participants produced research papers that met basic academic standards.

Information literacy showed substantial development throughout the study.



Students learned to search electronic databases, evaluate the credibility of scientific sources, organize references systematically, and avoid plagiarism. The use of digital technologies enabled participants to access current international research efficiently and strengthened their ability to work independently with scientific information. Collaborative learning also contributed significantly to competency development. Working in research teams improved communication skills, responsibility, leadership, and cooperation. Students exchanged ideas, solved methodological problems together, and supported each other throughout the research process. Such collaboration increased confidence and encouraged the sharing of innovative ideas. Reflective journals demonstrated that students became more aware of their own learning processes. Reflection enabled them to evaluate their strengths and weaknesses, recognize research difficulties, and identify strategies for future improvement. This continuous self-assessment promoted independent learning and lifelong professional development.

Overall, the results clearly indicate that the creative approach provided more effective didactic opportunities for developing scientific research competence than traditional teaching methods. The integration of inquiry-based learning, project-based learning, digital technologies, collaborative research, and reflective practice created a dynamic educational environment that enhanced students' professional readiness for research-oriented teaching.

Discussion

The results of this study confirm that the integration of a creative approach into teacher education significantly enhances the scientific research competencies of pre-service teachers. Students who participated in creativity-oriented learning demonstrated higher levels of research motivation, critical thinking, academic writing, information literacy, and independent inquiry than those who learned through traditional instructional methods. These findings indicate that creativity is



an essential factor in preparing future teachers for research-based professional practice. The improvement in research competence can be explained by the active nature of creative learning. Inquiry-based learning encouraged students to formulate research questions, analyze educational problems, collect evidence, and draw scientific conclusions independently. Such experiences enabled learners to connect theoretical knowledge with practical application and strengthened their confidence in conducting educational research. Project-based learning also contributed substantially to competency development. By completing authentic research projects, students improved their planning, collaboration, communication, and problem-solving skills. Working on real educational issues increased their professional responsibility and demonstrated the practical value of scientific research in improving teaching and learning.

Digital technologies played a crucial role in supporting research activities. Access to electronic libraries, scientific databases, reference management software, and collaborative online platforms enabled students to locate reliable information, organize research materials, and communicate scientific findings effectively. These digital competencies have become indispensable for modern educational researchers.

Reflective practice further strengthened professional development. Through regular reflection, students evaluated their research progress, identified learning difficulties, and developed strategies for continuous improvement. Reflection encouraged self-directed learning and promoted lifelong professional growth.

The findings suggest that higher education institutions should systematically integrate creativity-oriented instructional strategies into teacher education curricula. Such an approach creates favorable didactic conditions for developing innovative, research-oriented teachers capable of responding effectively to contemporary educational challenges.



Conclusion

The study concludes that a creative approach provides effective didactic opportunities for developing the scientific research competencies of pre-service teachers. Creativity-oriented instructional methods, including inquiry-based learning, project-based learning, collaborative research, reflective practice, and digital technologies, significantly improve students' research knowledge, critical thinking, academic writing, information literacy, and professional confidence.

The implementation of these approaches contributes to the preparation of competent teachers who are able to conduct scientific research, solve educational problems creatively, and apply research findings in professional practice. Therefore, universities should strengthen research-oriented learning environments by integrating creative pedagogical strategies into teacher education programs. This will support the preparation of innovative educators capable of contributing to educational quality, scientific development, and lifelong learning.

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