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PREPARING PRE-SERVICE TEACHERS FOR TECHNOLOGY-SUPPORTED ACTION RESEARCH IN AUTHENTIC CLASSROOM CONTEXTS

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Abstract. This thesis examines how pre-service teachers can be prepared to conduct technology-supported action research in authentic classroom contexts. It focuses on the integration of classroom inquiry, digital data collection, reflective analysis, ethical responsibility, and evidence-informed instructional improvement. The study describes the competencies required for identifying a practical pedagogical problem, formulating researchable questions, gathering and interpreting classroom evidence, testing a small-scale intervention, and presenting findings through digital tools. A staged methodological model based on observation, planning, action, monitoring, reflection, and revision is proposed. Particular attention is given to mentor support, school-university collaboration, data privacy, digital research portfolios, and the limits of automated analytics. The thesis argues that action research preparation can help future teachers become reflective practitioners who make justified pedagogical decisions in response to real learner needs.

Keywords: pre-service teacher, action research, classroom inquiry, digital tools, educational data, reflective practice, mentoring, research ethics.

Introduction

Teacher education increasingly emphasizes the need to prepare future teachers as reflective and research-oriented professionals. Classroom practice is complex, and many pedagogical problems cannot be solved through general prescriptions alone. Differences in student motivation, participation, prior knowledge, language background, access to technology, and classroom climate require teachers to examine their own practice carefully and to make decisions on the basis of evidence. Action research offers a practical framework for this purpose because it connects inquiry directly with the improvement of teaching and learning.

Technology has expanded the possibilities of action research. Digital surveys, learning management systems, video recordings, online observation forms, collaborative documents, spreadsheets, qualitative coding applications, and electronic portfolios can support data collection, organization, analysis, and communication. Nevertheless, the mere presence of digital tools does not guarantee valid or ethical research. Future teachers need to understand how to select appropriate evidence, protect participants, interpret data cautiously, and avoid replacing pedagogical judgment with automated indicators.

Authentic classroom contexts are especially important. Research tasks that remain hypothetical often fail to develop the full range of inquiry skills required in professional practice. Pre-service teachers need opportunities to identify real problems during school-based practice, collaborate with mentors, collect limited but meaningful evidence, implement a feasible intervention, and reflect on the consequences. Such experiences help connect university coursework with the realities of teaching.

The purpose of this thesis is to examine the methodological foundations and practical mechanisms for preparing pre-service teachers to conduct technology-supported action research in authentic classroom contexts. The discussion focuses on the nature of action research, the structure of

the required competence, the educational use of digital tools, ethical and methodological safeguards, mentor support, and a staged model for implementation.

Action Research as a Form of Teacher Inquiry

Action research is a systematic form of practitioner inquiry directed toward the understanding and improvement of professional practice. Unlike large-scale experimental research, it usually begins with a local problem experienced by a teacher or school community. Its aim is not to produce universal laws but to generate context-sensitive knowledge that can guide responsible action. The researcher is also a participant in the setting and therefore must combine involvement with critical reflection.

A typical action research cycle includes identifying a problem, reviewing relevant knowledge, planning an intervention, acting, collecting evidence, reflecting on the results, and revising the next course of action. The process is iterative rather than linear. Findings from one cycle often lead to a more precise problem definition or a modified intervention. This feature makes action research particularly suitable for teacher education because it mirrors the continuous adjustment required in classroom practice.

For pre-service teachers, action research develops several professional capacities at the same time. It strengthens observation, questioning, planning, data literacy, reflective thinking, collaboration, and communication. It also helps future teachers distinguish between personal impressions and evidence. For example, the statement that students are not interested in a lesson becomes more useful when it is connected with observable indicators such as participation patterns, task completion, questions asked, or student reflections.

Action research should not be presented as a simplified substitute for rigorous research. Even small-scale inquiry requires a clear question, appropriate evidence, transparent procedures, ethical responsibility, and cautious interpretation. Teacher educators must help students avoid conclusions that go beyond the data and must emphasize that improvement is judged in relation to a specific context.

Competencies Required for Technology-Supported Classroom Inquiry

The first required competence is the ability to identify and define a researchable pedagogical problem. Pre-service teachers often begin with broad concerns such as low motivation, weak participation, or poor achievement. These concerns must be narrowed by specifying the learners, context, observable behavior, possible causes, and practical significance. A focused question makes it possible to collect relevant evidence and design a manageable intervention.

The second competence is digital research literacy. Future teachers should know how to use digital tools to gather, store, organize, and visualize information. They may create online questionnaires, use electronic checklists, record classroom interactions, collect student work through a learning platform, or prepare simple charts. However, tool selection should follow the research question. A video recording may be suitable for analyzing classroom interaction, while a brief survey may be more appropriate for exploring student perceptions.

The third competence is data interpretation. Pre-service teachers need basic quantitative and qualitative analysis skills. They should be able to calculate simple frequencies, compare patterns across lessons, categorize open responses, identify recurring themes, and connect evidence from different sources. Triangulation is important because a single data source may produce an incomplete or distorted picture. Observation, student work, and learner feedback can complement one another.

The fourth competence is intervention design. The proposed action should be realistic, ethically acceptable, connected with the identified problem, and possible within the period of teaching practice. An intervention may involve changing instructions, introducing peer feedback, using a digital formative assessment tool, reorganizing group work, or providing differentiated resources. The future

teacher should explain why the intervention is expected to help and what evidence will indicate change.

The fifth competence is reflective communication. Findings should be presented clearly to mentors, peers, and relevant school participants. A digital research portfolio can include the problem statement, instruments, anonymized evidence, lesson materials, analytic notes, reflections, and revisions. Such documentation makes the inquiry process visible and supports feedback.

Digital Tools for Data Collection and Analysis

Digital tools can increase the efficiency and transparency of classroom inquiry when they are used selectively. Online forms allow pre-service teachers to collect short student responses quickly, while learning management systems provide records of submission, participation, and feedback. Collaborative documents support peer coding and joint analysis. Spreadsheets can organize observations, calculate simple descriptive indicators, and create visual summaries.

Video is especially valuable for action research because classroom events are difficult to remember accurately. A recording can be reviewed several times to examine teacher talk, wait time, student participation, movement, or the use of instructional resources. Yet video data require careful consent and secure storage. Only the necessary part of the lesson should be recorded, access should be limited, and identifiable material should not be shared beyond the agreed purpose.

Digital annotation and coding tools can support qualitative analysis. Pre-service teachers may label repeated themes in student comments, tag classroom events, or connect evidence with reflective notes. However, software should not be treated as an analyst. Categories must be defined by the researcher, and interpretation should remain grounded in the classroom context.

Automated analytics must be used cautiously. Platform dashboards may display attendance, completion, time spent, or quiz performance, but such indicators do not explain why a learner acted in a particular way. Low participation may reflect technical access, confidence, language difficulty, unclear instructions, or external circumstances. Digital data should therefore be interpreted together with observation and dialogue.

The choice of technology should also consider accessibility and workload. A complex application may create more difficulty than value. Teacher educators should encourage students to use the simplest tool that can answer the research question reliably and safely.

Authentic Classroom Contexts and School-University Collaboration

Action research preparation is most effective when university coursework and school practice are connected. The university can provide theoretical knowledge, research methods, ethical guidance, and analytic support, while the school offers real problems, learners, routines, and professional constraints. Cooperation between university supervisors and school mentors helps ensure that inquiry is both academically sound and practically relevant.

Problem selection should be negotiated with the mentor teacher. The issue must matter to the classroom, but it should also be small enough for a pre-service teacher to study responsibly. Questions that involve high-stakes evaluation, sensitive personal information, or major changes to school policy are usually inappropriate for initial projects. Suitable inquiries focus on a limited aspect of instruction or participation.

The mentor plays several roles. The mentor helps the student understand the classroom context, checks whether the intervention is feasible, supports access to evidence, and provides feedback on interpretation. At the same time, the mentor should not dictate the entire project. The pre-service teacher needs ownership of the question and responsibility for the inquiry process.

School-university collaboration should also clarify expectations about data. Participants need to know what will be collected, who will see it, how long it will be stored, and how the findings will be reported. Clear procedures reduce uncertainty and protect trust. The main purpose should remain

professional learning and classroom improvement rather than external judgment of students or teachers.

Ethical and Methodological Safeguards

Ethics is central to classroom action research because participants are often minors and the researcher has a developing professional role. Pre-service teachers must respect informed consent, voluntary participation where applicable, confidentiality, anonymity, and the right to withdraw. They should collect only data that are necessary for the research question and should remove identifying details from reports and portfolios.

Power relations also require attention. Students may feel obliged to participate because the researcher is involved in teaching. Therefore, research activities should not affect grades, access to learning, or the quality of teacher support. When direct consent procedures are required, they should be managed according to institutional and school rules.

Methodological quality depends on the alignment among the question, intervention, evidence, and conclusion. A short project cannot prove that one method is universally effective. It can show that a particular change was associated with certain patterns in a specific group. Conclusions should acknowledge alternative explanations and limitations such as small sample size, short duration, incomplete data, or the influence of the researcher.

Reflexivity is another safeguard. The pre-service teacher should record expectations, assumptions, and decisions throughout the project. Such notes help reveal how the researcher's position may have influenced observation and interpretation. Mentor and peer review can further strengthen credibility by challenging unsupported claims.

Digital security must be included in research planning. Devices should be password protected, files should be stored in approved locations, access should be limited, and unnecessary copies should be deleted. Public cloud services should not be used for sensitive classroom data unless institutional permission and appropriate safeguards are in place.

A Staged Methodological Model for Teacher Education

A six-stage model can guide the preparation of pre-service teachers. The first stage is orientation. Students study the purpose, cycle, ethics, and limits of action research and examine examples of small classroom inquiries. They learn to distinguish a practical problem from a general topic and to identify evidence that could support inquiry.

The second stage is problem exploration. During observation or teaching practice, students keep structured field notes, discuss possible issues with mentors, and collect preliminary non-sensitive evidence. They then formulate a focused research question and explain its relevance to learning.

The third stage is research design. Students select data sources, prepare instruments, define an intervention, establish ethical procedures, and create a realistic timeline. The university supervisor and school mentor review the plan before implementation.

The fourth stage is action and monitoring. The intervention is applied on a limited scale, and evidence is collected through appropriate digital and non-digital methods. The student keeps a research journal to document unexpected events, decisions, and adaptations.

The fifth stage is analysis and reflection. Students organize data, compare sources, identify patterns, and relate findings to the original question. They discuss the evidence with mentors and peers, consider limitations, and decide what should be maintained, changed, or explored further.

The sixth stage is communication and revision. The project is presented through a concise report and digital portfolio. The focus is not only on whether the intervention succeeded but also on what the student learned about inquiry, teaching, learners, and professional decision-making. A revised action plan may be proposed for a second cycle.

Assessment of Pre-Service Teachers' Action Research Competence

Assessment should examine the quality of the inquiry process rather than the appearance of the final product alone. Key criteria include the clarity and relevance of the problem, alignment of the research question with evidence, appropriateness of the intervention, ethical compliance, quality of analysis, caution of conclusions, and depth of reflection.

A portfolio-based approach is useful because it captures development over time. Evidence may include observation notes, research questions, instruments, consent documentation, anonymized data samples, lesson materials, analytic memos, feedback, and revised plans. The portfolio should show how decisions changed in response to evidence.

Self-assessment and peer assessment can strengthen metacognition. Students may use a rubric to evaluate their own inquiry and then compare their judgment with feedback from mentors and supervisors. Differences in evaluation become opportunities for discussion about standards and evidence.

The success of preparation should also be seen in professional dispositions. Future teachers should demonstrate curiosity, openness to feedback, willingness to revise practice, respect for participants, and the ability to tolerate uncertainty. These qualities are essential for sustained inquiry beyond the formal project.

Implementation Challenges and Strategies for Sustainable Practice

Finally, institutions should recognize that technology-supported action research requires an enabling infrastructure. Approved digital platforms, secure storage, clear ethical procedures, access to technical assistance, and time for mentor consultation are necessary conditions. Without these supports, the burden of compliance and problem solving falls unfairly on individual students and may discourage meaningful inquiry.

Peer collaboration can also support sustainability. Pre-service teachers may form inquiry groups that discuss problems, review instruments, examine anonymized evidence, and question interpretations. Such groups develop a professional language of inquiry and reduce the isolation that often accompanies classroom experimentation. Peer critique should remain respectful, evidence-based, and focused on improvement.

The sustainability of action research depends on whether students see it as part of teaching rather than as a temporary academic assignment. Repeated small inquiries across several courses or practicum periods can help normalize the cycle of questioning, evidence collection, reflection, and revision. Over time, students can move from highly structured tasks toward more independent projects.

Mentor consistency is equally important. University supervisors and school mentors may use different expectations or research terminology. Shared orientation sessions, common rubrics, and brief communication protocols can reduce confusion. When mentors understand the purpose and scope of the project, they are better able to provide focused feedback without taking ownership away from the student.

Another difficulty is the interpretation of mixed or negative results. Students may expect every intervention to produce improvement and may feel that an unchanged outcome represents failure. Teacher educators need to emphasize that a well-documented null or unexpected result can still generate important professional knowledge. The central criterion is the quality of reasoning and reflection, not the production of a positive result.

Time pressure during teaching practice can also reduce the quality of inquiry. Pre-service teachers are simultaneously planning lessons, adapting to school routines, and meeting university requirements. The action research task should therefore be integrated into normal teaching responsibilities. Data collection methods should be brief, repeated, and closely connected with lessons rather than added as a separate burden.

A second challenge is excessive dependence on digital tools. Students may select an application because it is available or visually attractive rather than because it serves the research purpose. Training

should begin with the question and evidence needs, not with the tool. The student should be able to justify why a particular technology is necessary and what limitations it introduces.

One common challenge is the tendency to make an action research project too broad. Pre-service teachers may attempt to study motivation, achievement, classroom management, and technology use at the same time. Teacher educators should therefore require a narrow question, a limited intervention, and a realistic data plan. A small inquiry completed carefully is more educationally valuable than an ambitious project supported by weak evidence.

Conclusion

Preparing pre-service teachers for technology-supported action research can strengthen the connection between teacher education and authentic classroom practice. It enables future teachers to identify practical problems, collect and interpret evidence, test feasible interventions, and improve instruction through reflection.

Digital tools can support this process by making data collection, organization, analysis, and presentation more efficient. Their value, however, depends on careful selection, ethical use, secure data management, and critical interpretation. Automated indicators should inform rather than replace professional judgment.

The proposed staged model combines orientation, problem exploration, research design, action, analysis, reflection, and communication. Its effectiveness depends on mentor support, school-university collaboration, authentic but manageable problems, and assessment that values the quality of inquiry. Through such preparation, pre-service teachers can develop as reflective practitioners capable of making evidence-informed decisions in response to real learner needs.

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