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Transforming research methodologies in teacher education: a systematic comparative review of global trends and the Kazakhstani experience

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Global transformations in education, including digitalization, sustainability-oriented learning, and practice-based pedagogical innovation, have intensified interest in research-oriented teacher education. This study presents a systematic review of international and Kazakhstani literature on research methodologies in teacher education, with the aim of identifying dominant methodological approaches, comparing thematic and conceptual priorities across contexts, and clarifying the role of Action Research within this broader landscape. The review was conducted in accordance with PRISMA principles and drew on publications from the journal *Education Sciences* indexed in Scopus and from Kazakhstani journals recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan. The analysis combined quantitative screening, thematic coding, and comparative synthesis. The findings show that international literature conceptualizes research activity primarily as reflective, inquiry-based, and practice-oriented, while Kazakhstani studies more often frame it as a strategic and institutional priority linked to the modernization of teacher education. Across both contexts, Action Research emerges as a significant, though not exclusive, methodology for connecting reflection, inquiry, and professional change. The study contributes to current scholarship by offering a comparative analytical synthesis of research-oriented approaches in teacher education and by identifying conceptual and methodological gaps relevant to the further development of teacher education in Kazakhstan.

KEYWORDS

action research, formal and non-formal research methods, global trends, sustainability of research results, systematic review, teacher research activity, teacher-researcher

1 Introduction

In contemporary higher education, the development of research-oriented teacher education has become increasingly important in response to global transformations such as digitalization, education for sustainable development, active learning, and the growing demand for pedagogical innovation. These shifts require not only the modernization of educational content and technologies, but also the strengthening of teachers' research capacity as a basis for reflective, evidence-informed, and context-sensitive professional practice. In this regard, research activity is no longer viewed as an additional academic function, but as an integral dimension of teaching and professional growth.

International scholarship increasingly emphasizes that the quality of teacher education depends on the extent to which future and practicing teachers are able to engage in inquiry, analyze pedagogical problems, and connect educational theory with authentic professional contexts. In different national settings, this orientation has taken the form of enquiry-based learning, project-based learning, design-based professional learning, collaborative research, and Action Research. These approaches are united by a common assumption: teacher education is more effective when it supports not only knowledge transmission, but also the development of reflective and research-oriented professional agency.

At the same time, although the international literature offers a wide range of studies on research-based and practice-oriented approaches in teacher education, the available evidence remains fragmented across themes, methods, and contexts. In particular, there is still a lack of comparative analytical synthesis showing how research activity is conceptualized and supported in different educational environments, especially when international trends are compared with the evolving pedagogical research landscape of Kazakhstan. Much of the existing literature either focuses on isolated approaches or remains descriptive in its treatment of broader educational transformations.

Global educational transformations, including digitalization, sustainability-oriented learning, and active pedagogical innovation, have increased the importance of research-oriented teacher education. Contemporary scholarship emphasizes that education should be grounded in meaningful experience, contextualized learning, and reflective engagement with practice (Howard, 2018; Ketelhut et al., 2023). At the same time, new methodologies and tools are being developed to examine and improve the learning process in increasingly complex educational environments (Sousa et al., 2021). Recent research in higher education has highlighted the importance of methodological knowledge, research competence, and pedagogical practices in teaching research methods, while also pointing to persistent challenges in engaging both teachers and students in collaborative inquiry (Matos et al., 2023).

International experience further demonstrates that teacher education increasingly relies on practice-based and inquiry-oriented approaches. The United Kingdom's *Teacher as Researcher* tradition, grounded in qualitative inquiry and action research, positioned teachers as practitioners capable of investigating their own professional contexts (Cunningham, 1993; Denzin and Lincoln, 2011; Glesne and Peshkin, 1992). Related studies also stress the importance of practitioner research, widening participation, and research-informed innovation in educational

practice (Baines and Gregson, 2020). In the United States, attention has been given to research-based and student-centered strategies such as problem-based and project-based learning, which strengthen engagement in inquiry processes (Kultaeva et al., 2023; St. John, 2023). Finnish experience has likewise shown the value of integrating pedagogical theory, practice, and research, particularly through action research and collaborative models of teacher preparation (Palmu, 1998; Wolff et al., 2017).

In Kazakhstan, the modernization of higher pedagogical education has also intensified the need to strengthen teachers' research competence. The national policy agenda, including the Concept for the Development of Higher Education and Science of the Republic of Kazakhstan for 2023–2029, places particular emphasis on the preparation of a new generation of specialists through enhanced scientific capacity and renewed educational programs. In this context, research-oriented teacher education requires not only formal research methods, but also practice-based and non-formal forms of inquiry that enable teachers to transform their professional practice through reflection and systematic investigation (Concept, 2023). Action Research is especially relevant in this regard, as it supports the integration of research and practice directly within the educational process (Berik Khanova et al., 2023a, b).

The novelty of this study lies in its comparative analytical synthesis of international and Kazakhstani literature on research methodologies in teacher education. Unlike studies that focus on isolated pedagogical innovations or provide descriptive overviews of educational trends, this review identifies dominant methodological approaches, compares their conceptual and practical orientations across contexts, and clarifies how research activity is positioned within contemporary teacher education. The theoretical contribution of the study consists in systematizing research-oriented approaches in teacher education and in locating Action Research within a broader methodological framework rather than presenting it as an isolated or universally preferred solution.

The aim of this study is to conduct a systematic comparative review of international and Kazakhstani literature on research methodologies in teacher education in order to identify dominant thematic patterns, compare conceptual and methodological orientations, and examine the analytical significance of Action Research within this broader field.

The review was guided by the following research questions:

1. What research-oriented approaches are most frequently discussed in international and Kazakhstani literature on teacher education?
2. What conceptual and methodological similarities and differences can be identified between the two contexts?
3. What role does Action Research play within the reviewed body of literature, and how strongly is its educational relevance supported by the review findings?

2 Materials and methods

2.1 Study design and review purpose

This study employed a systematic literature review design based on PRISMA principles in order to ensure transparency,

consistency, and analytical rigor in the identification, selection, and synthesis of relevant studies. The review focused on research methodologies and research-oriented approaches in teacher education, with particular attention to the development of research activity, research competence, reflective practice, and practice-based inquiry in higher pedagogical education (Page et al., 2021).

The purpose of this study is to analyze the current state of research methods in the professional practice of university teachers, to identify problems and trends in changing and improving practices. The methodology based on the collection and analysis of quantitative and qualitative data was taken as a basis. The work was based on the PRISMA research design guidelines “Preferred reporting elements for systematic literature reviews and meta-analyses”.

2.2 Methods: data sources, search strategy, selection criteria and selection processes

The study was carried out using the method of literature review, content analysis, and comparative analysis. The main sources of information were:

Two literature corpora were used in the review. The international corpus was drawn from publications in the journal Education Sciences indexed in Scopus. The Kazakhstani corpus was drawn from journals in the field of education recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan. The international review covered publications from 2011 to 2024, while the Kazakhstani review covered publications from 2017 to 2024, corresponding to the period of accessible digital archiving and open availability.

2.2.1 Search strategy

The search was conducted using combinations of keywords related to teacher education, research activity, research competence, research methods, pedagogical technologies, Action Research, Lesson Study, project-based learning, and non-formal research methods. Searches were performed in English, Russian, and Kazakh where appropriate. Records were identified on the basis of titles, keywords, and thematic relevance within the field of education and related social sciences.

2.2.2 Eligibility criteria

Studies were included if they:

1. addressed teacher education or higher pedagogical education;
2. focused on research activity, research competence, research methods, or research-oriented pedagogical approaches;
3. presented a clear conceptual, methodological, or practical contribution relevant to the review questions;
4. were available in full-text form; and
5. were published within the selected time period.

Studies were excluded if they:

1. were editorials or non-analytical commentaries;
2. were unrelated to teacher education or research-oriented pedagogical practice;
3. duplicated previously identified records; or
4. did not contain sufficient methodological or thematic information for analysis.

2.2.3 Screening and study selection

The study selection process was carried out in three stages. First, records were identified through database searching. Second, titles, keywords, and abstracts were screened for thematic relevance. Third, full-text articles were assessed against the inclusion and exclusion criteria. Duplicate and irrelevant records were removed during the screening process. The final set of included studies constituted the analytical basis of the review and is summarized in the PRISMA flow diagram.

2.2.4 Data extraction and coding

The selected studies were subjected to thematic coding and comparative synthesis. Each article was analyzed according to the following categories: conceptual focus, type of research-oriented approach, target group, role of research activity in teacher education, contextual conditions of implementation, and reported educational value. Through iterative coding, recurrent thematic clusters were identified and later grouped into broader analytical categories for cross-context comparison.

2.2.5 Comparative analytical procedure

To compare the international and Kazakhstani corpora, the analysis was organized around three dimensions:

1. how research activity is conceptualized;
2. which methodological approaches are used to support it; and
3. under what institutional and pedagogical conditions these approaches are implemented.

This comparative framework made it possible to move beyond descriptive listing and toward analytical interpretation of similarities, differences, and context-specific patterns.

2.2.6 Analytical reliability and limitations

To strengthen analytical consistency, the coding categories were applied systematically across both corpora and refined during repeated reading of the selected studies. Interpretive validity was supported through cross-checking of thematic groupings and through alignment of analytical claims with the reviewed literature. At the same time, the review is limited by the scope of selected databases and journals, as well as by differences in terminology and methodological depth across the included studies.

The selection took place in three stages. In the first stage, the total number of results submitted according to the selection criteria - pedagogical topics ($n = 6,108$) was recorded. After that,

all titles and keywords were read. The initial screening allowed familiarization with their content. At the end of the first stage of the search, the total number of selected studies ($n = 164$) was recorded. In the second stage (comprehensive screening), abstracts of all selected studies were read. Cross-checking was performed among all selected studies to identify repetitions and potential for exclusion. This was done by all authors independently, using the same algorithm, and a total of 92 articles were retained. A third step (final comprehensive screening) was then applied, which involved reading the full texts, and a total of 79 articles were retained.

The study selection process and the number of records retained at each stage are presented in the PRISMA flow diagram (Figure 1).

2.3 Methods: selection of data elements, analysis

Two databases were used to identify studies. The first database was the database of the international peer-reviewed journal “Education Sciences” of the MDPI publishing platform of the SCOPUS database, and the second database used was the database of recommended journals by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan (COCSEQA of the Ministry of Science and Higher Education of the Republic of Kazakhstan). For both databases, the selection process involved a set of search queries for the terms ‘research’, ‘methods’ and ‘teaching’ and their combinations in the three research languages (English, Kazakh, Russian). In the first stage, a total of 6,108 articles were identified. After applying the first set of selection criteria, 5,944 records were excluded. For the remaining 164 studies, according to the total number of records, the screening process was initiated. After excluding repeats, the final number of studies was 98. After applying the third set of screening criteria, we reached a final number of 98 studies. The selected 79 studies constituted the empirical material for the review of the scientific literature presented in this article.

Content analysis of articles in the journal “Education Sciences” of the publishing platform MDPI of the database SCOPUS from the beginning of publication in 2011 to 2024.

The dynamics of publications on the problem under study is shown in the graph (Figure 2).

The content analysis of the selected 54 publications also revealed a certain dynamic of articles on the highlighted issues (Figure 3)

The quantitative analysis showed the dynamics of publications on the research topic by 2016 and stabilization of interest in the period from 2017 to 2024.

In the database of journals recommended for publication by the Committee for Quality Assurance in the Sphere of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, a total of 2,537 articles were published between 2017 and 2024. Of these, only 40 articles addressed issues related to the research activities of participants in the educational process, representing just 1.57% of the total number of publications. At the same time, a positive trend can be observed. The data are presented in Figures 4, 5).

3 Results

The results of the systematic review are organized in accordance with the research questions and are presented in three analytical parts: the international corpus, the Kazakhstani corpus, and the comparative synthesis. The analysis moved beyond descriptive listing and focused on identifying recurrent methodological patterns, thematic priorities, and contextual differences in how research activity is conceptualized within teacher education.

The analysis of international literature revealed four dominant thematic clusters: research approaches ($n = 13$) and pedagogical technologies, teachers’ research competencies ($n = 10$), research-oriented strategies in teacher education ($n = 19$) and student involvement in research ($n = 10$). Across these clusters, the international literature conceptualizes research activity not as an isolated academic requirement, but as an integral element of reflective, inquiry-based, and practice-oriented teacher education. A notable feature of this corpus is its methodological diversity: approaches such as Problem-Based Learning, Project-Based Learning, design-based professional learning, enquiry-based strategy, and Action Research are discussed as mechanisms for linking pedagogical reflection, professional learning, and authentic educational contexts.

3.1 International literature on research methodologies in teacher education

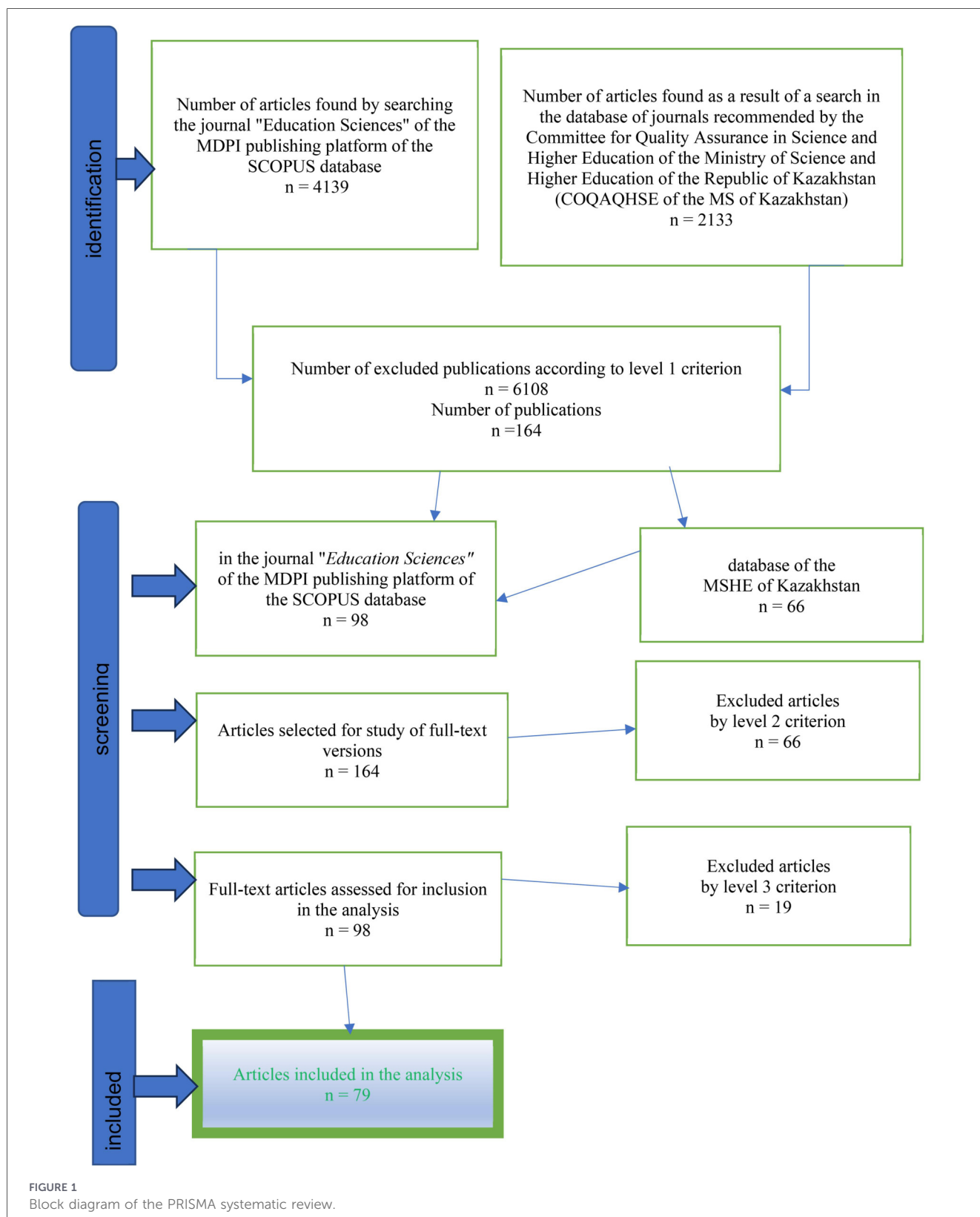
The analysis of the international literature revealed four dominant thematic clusters:

1. research approaches, pedagogical technologies, and methods;
2. teachers’ research competencies;
3. research-oriented strategies in teacher education; and
4. student involvement in research.

Across these clusters, the international literature conceptualizes research activity not as an isolated academic requirement, but as an integral component of reflective, inquiry-based, and practice-oriented teacher education. A notable feature of this corpus is its methodological diversity. The reviewed studies discuss a broad range of approaches, including Problem-Based Learning, Project-Based Learning, project-based blended learning, enquiry-based strategy, design-based professional learning, collaborative inquiry, and Action Research. These approaches are presented as mechanisms for linking educational theory, pedagogical reflection, and authentic professional contexts.

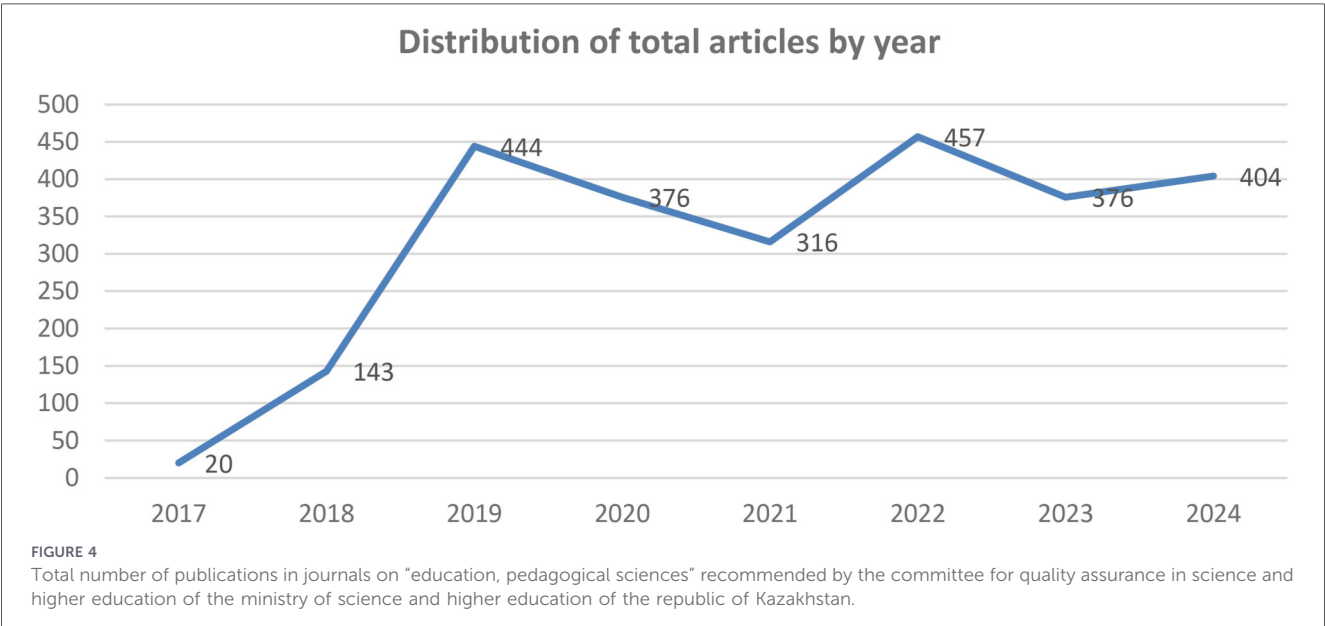
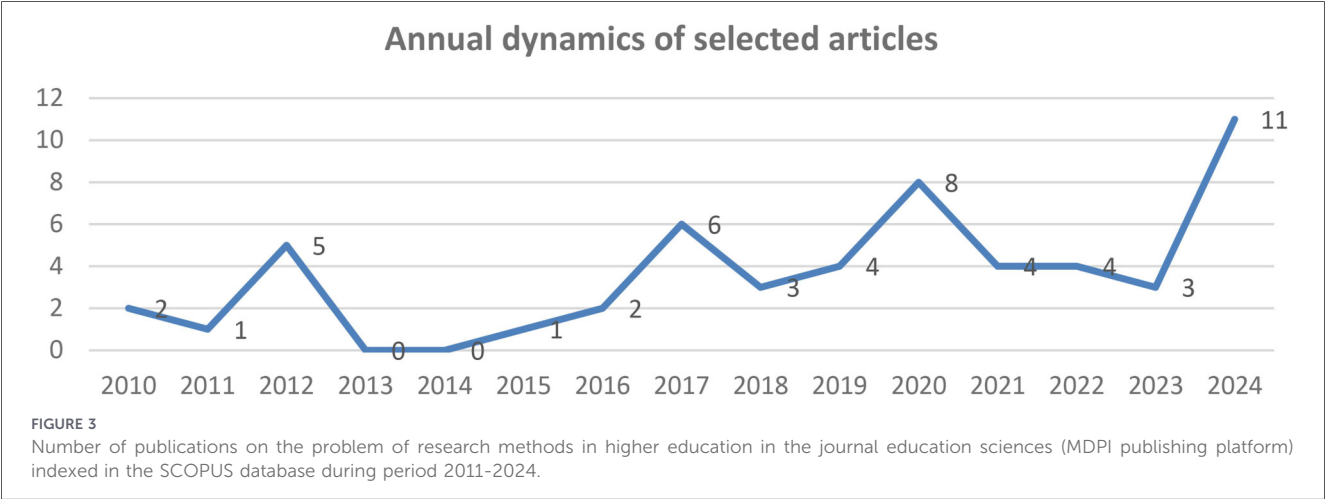
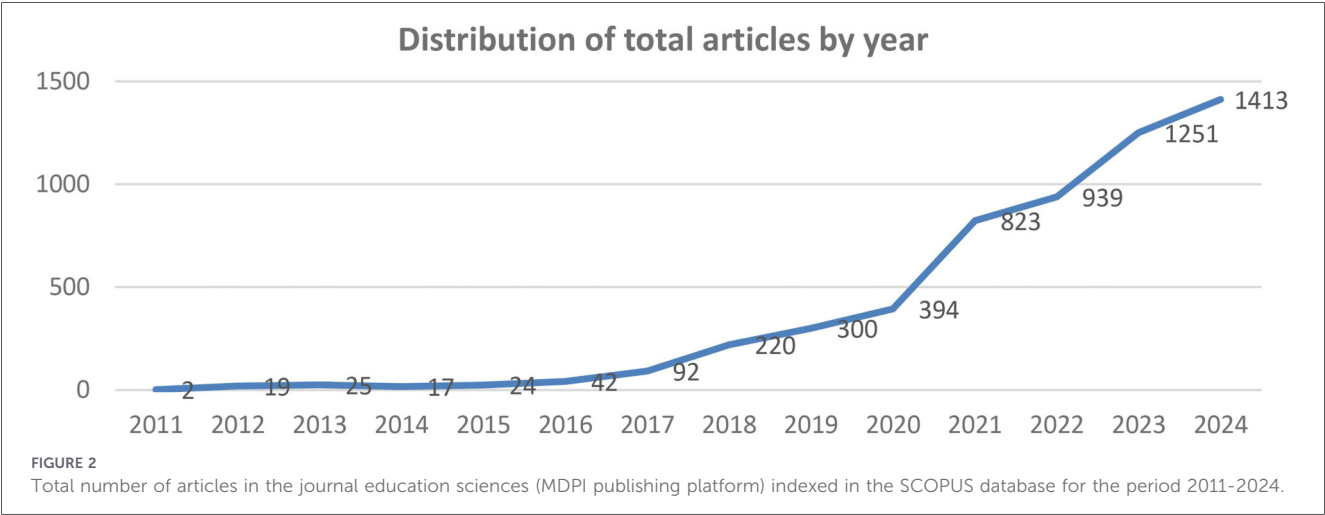
A second important characteristic of the international literature is its strong focus on teachers’ research competencies as part of broader professional agency. Research competence is associated not only with methodological literacy, but also with reflective capacity, collaborative practice, professional self-efficacy, and the ability to investigate and transform one’s own pedagogical environment. In this sense, the teacher is increasingly positioned as a researcher-practitioner whose professional growth is closely connected to inquiry into practice.

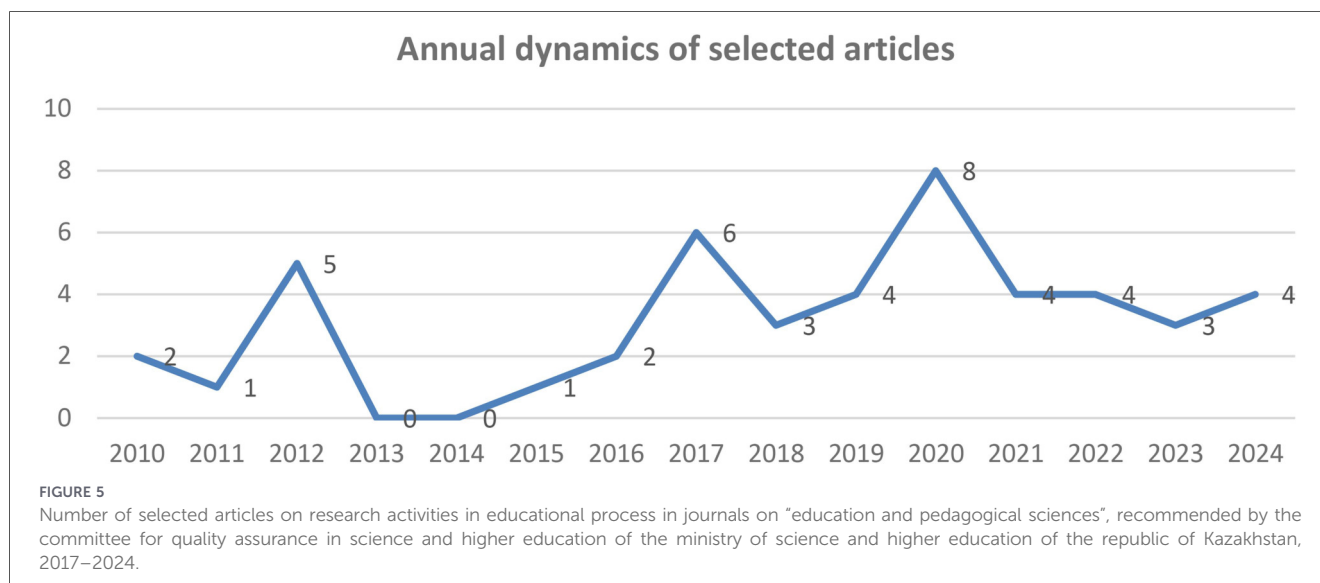
The reviewed studies also show that research-oriented teacher education is strongly connected with student engagement. In the



international corpus, student involvement in research is discussed through concepts such as scientific literacy, research skills, open inquiry, and undergraduate research. This indicates that the development of research activity is understood as a shared pedagogical process involving both teachers and students.

Overall, the international corpus demonstrates a mature and differentiated research landscape in which methodological approaches are not only named, but also analyzed in relation to implementation conditions, learning processes, and professional outcomes. This makes the international literature particularly





valuable for identifying analytically grounded models of research-oriented teacher education.

3.1.1 Block 1: research approaches, technologies and methods

The international literature shows that research-oriented teacher education is increasingly shaped by methodological diversity and the growing use of innovative pedagogical technologies. Although traditional approaches remain present, many studies emphasize the need to renew teaching methods in response to digitalization, changing learner expectations, and the growing importance of inquiry-based and active learning in higher education (Brown et al, 2020; Rodríguez Jiménez, 2019). In this context, innovation is viewed not simply as the introduction of new tools, but as a broader transformation of educational practice through collaboration, experimentation, and more flexible pedagogical design.

A recurring theme in the reviewed studies is the shift toward active and student-centered learning environments. Researchers highlight the importance of pedagogical methods that foster collaboration, co-creativity, and experimental learning culture, particularly in teacher education programs preparing future educators for dynamic professional contexts (Androutsos and Brinia, 2019; Pološki Vokić and Aleksić, 2020). These approaches are seen as especially relevant for contemporary students, who increasingly prefer interactive, technology-supported, and practice-oriented ways of learning.

Problem-Based Learning and Project-Based Learning are among the most frequently discussed methodologies in this cluster. Problem-Based Learning is described as an instructional strategy that enables students to investigate problems, connect theory with practice, and apply knowledge in meaningful ways (Savery, 2006). Project-Based Learning, in turn, gives learners greater responsibility for their own educational process while positioning the teacher as a facilitator and guide. Studies show that such approaches contribute to authentic learning experiences, increase student

engagement, and strengthen the practical relevance of university education (Ngereja et al., 2020).

The literature also points to newer variations of these approaches, including Project-Based Blended Learning, the Scrum method, and active learning technologies. These formats are associated with the development of critical thinking, independent inquiry, teamwork, and motivation, while also supporting the integration of learning with professional practice (Alamri, 2021; Jaiswal et al., 2021; Townley, 2018). Overall, the reviewed studies suggest that research-oriented pedagogies are most effective when they create conditions for student autonomy, collaborative problem-solving, and the application of knowledge in authentic educational contexts.

3.1.2 Block 2: research competencies of teachers

The reviewed literature shows that teachers' research competence extends beyond methodological literacy and includes scientific culture, reflective capacity, and the ability to investigate and improve one's own practice. In this context, teachers are increasingly viewed not only as instructors, but also as practitioner-researchers who must be prepared to respond to complex educational challenges through inquiry. Kinchin (2019) describes this problem through the concept of *pedagogical fragility*, arguing that effective university teaching requires stronger links between pedagogy and disciplinary knowledge, as well as a capacity for continuous reflection and modification of practice. This perspective highlights that professional competence in higher education is not static, but recursive and developmental.

A related line of research is represented by the concept of widening participation, which emphasizes immersion in professional context, systematic reflection, and the integration of research with practice. In this view, practitioner-researchers are expected not only to monitor and evaluate their work, but also to contribute to educational improvement through evidence-informed inquiry (Baines and Gregson, 2020). Similar ideas are reflected in studies of transformative learning, where reflection

and critical analysis are seen as key mechanisms for professional growth and change (Leach et al., 2012; Sterling, 2010).

The literature also stresses that one of the core competencies of a teacher-researcher is the ability to work collaboratively. Teamwork is understood not simply as cooperation, but as a productive process in which diverse forms of expertise are mobilized to address shared professional tasks (Edmondson, 2012; West, 2012). In this regard, Brundiers and Wiek (2017) identify a broader set of professional capacities relevant to both teachers and students, including communication, project management, stakeholder engagement, and lifelong learning. These competencies are important because they support both professional adaptability and the social relevance of educational change.

Finally, research on teachers' self-efficacy suggests that research competence is closely connected with practical teaching experience, instructional strategies, student engagement, and fair evaluation of professional performance. Shah and Bhattarai (2023) show that experienced teachers are generally better positioned to sustain engagement, apply effective strategies, and share knowledge with colleagues. Taken together, the reviewed studies indicate that research competence in teacher education should be understood as a multidimensional construct that combines methodological knowledge, reflective inquiry, collaboration, and the ability to transform practice in response to changing educational conditions.

3.1.3 Block 3: strategies and research approaches in teacher education

The reviewed literature shows that research approaches in teacher education are primarily aimed at addressing the diverse needs of learners while strengthening teachers' research competence, pedagogical flexibility, and collaborative capacity. In this context, teacher education is increasingly understood not only as the transmission of professional knowledge, but also as the creation of conditions for reflective inquiry and sustained professional development. Tirri (2021) emphasizes that more research is needed on teachers' values, beliefs, and cognitive and social skills, as these factors directly influence both their willingness to learn and their capacity to improve educational practice.

A central idea in this cluster is that effective teacher education requires research-informed strategies capable of linking micro-level teaching practice with broader pedagogical and institutional frameworks. Sánchez-Cabrero et al. (2021) identify several models of teaching effectiveness, including observation-based and comparative approaches, showing that research can support both reflection and the systematic evaluation of professional performance. Hattie and Zierer (2017) similarly argue that successful teaching depends not only on teachers' knowledge, but also on their professional mindframes, especially their willingness to seek challenges, build trust, use feedback, and collaborate with colleagues.

The literature further highlights enquiry-based and problem-oriented strategies as especially valuable in the preparation of future teachers. Enquiry-based strategy encourages preservice teachers to engage with subject content through research practice, thereby strengthening their research competence and their readiness to apply inquiry within educational settings (Aragón and Gómez-Chacón, 2022). Related approaches, such as

problem-oriented and project-based learning, create authentic learning environments in which students work collaboratively with real or simulated educational problems, often under flexible forms of supervision (Acton, 2019; Molina-Torres 2022). These strategies are particularly important because they connect professional learning with real educational contexts and support the development of reflective and investigative dispositions.

Another significant approach in this cluster is design-based professional learning. Research in this area conceptualizes teacher learning as a cyclical and evidence-informed process closely connected to practice and continuous improvement (Brown et al., 2020; Darling-Hammond et al., 2017; Hendricks, 2012; Timperley, 2011) and related studies describe design-based professional learning as a collaborative format in which teachers work with practitioner-researchers to create, test, and refine educational solutions in real contexts. Its main strength lies in its cyclical, interactive, and context-sensitive nature, which allows teachers to critically engage with their own practice while receiving structured support from peers and experts (Calvert, 2016; Gachago, 2017; Laurillard, 2018; Voogt et al., 2015).

3.1.4 Block 4: involvement of students in research

Student engagement is presented in the reviewed literature as a central condition for the success of educational research. It is understood as a multidimensional phenomenon that includes emotional, behavioral, and cognitive involvement in learning, and is closely connected with academic achievement and the overall quality of the educational process (Tomaszewski et al., 2022). A number of studies also show that student engagement in research is influenced by individual learning styles and by the level of students' readiness for active forms of learning. Loo, (2022) identifies different learner profiles based on combinations of concrete experience, active experimentation, reflective observation, and abstract conceptualization, while Pološki Vokić and Aleksić (2020) note that more creative and reflective students tend to show stronger preference for active learning methods. These findings suggest that research-oriented pedagogies should be flexible enough to accommodate different modes of participation and learning.

Another important theme in this block is the development of students' research skills and scientific literacy. The literature defines research skills as teachable and practicable activities that enable students to formulate questions, collect and analyze data, and draw conclusions (Laidlaw et al., 2012). At the same time, problem-solving and the scientific method are seen as central mechanisms for strengthening these skills in higher education (Lira et al., 2022; Vázquez-Villegas et al., 2023). O'Toole et al., (2020) further propose the Access-Engage-Utilize model as a way of supporting student participation in research, while Drumond Vieira et al. (2017) emphasize that scientific literacy involves not only conceptual understanding, but also the ability to act from an epistemologically informed perspective when confronting real problems.

The reviewed studies also show that more advanced forms of student engagement in research require a significant degree of autonomy. In this regard, open inquiry is described as a particularly valuable format, as it enables students to independently select questions, organize teamwork, and manage

research resources within small-group exploratory settings (Hacisalihoglu et al., 2020; Maltese et al., 2017). Such approaches contribute not only to student engagement, but also to the development of self-regulation, only to student engagement, but also to the development of self-regulation, collaboration, and higher-order inquiry skills. Overall, the literature suggests that involving students in research is not an automatic outcome of instruction; rather, it depends on the purposeful development of scientific literacy, research skills, and supportive pedagogical environments.

Overall, the international corpus demonstrates a mature and differentiated research landscape in which methodological approaches are not only identified, but also interpreted in relation to implementation conditions, learning processes, and professional outcomes. This makes the international literature particularly valuable for identifying analytically grounded models of research-oriented teacher education.

Table 1 summarizes the key categories identified through thematic coding of the reviewed literature and reflects the main analytical blocks used in the comparative synthesis.

A similar thematic logic was identified in the Kazakhstani corpus, although with a different distribution of emphases and a narrower range of analytically elaborated methodological approaches. These patterns are discussed in the following section.

3.2 Kazakhstani literature on research methodologies in teacher education

The selected publications of the database of Kazakhstani scientific journals were also systematized in accordance with the selected semantic blocks: development of teachers' research activity through research in action ($n = 6$); formation of future teachers' research activity ($n = 18$); teacher's research competencies ($n = 2$); project methods of research activity development ($n = 10$).

3.2.1 Block 1: development of teachers' research activity through action research (action research)

One of the most visible directions in the Kazakhstani literature is the development of teachers' research activity through Action Research (Berikkhanova et al., 2023). The reviewed studies present this approach as a promising means of strengthening research engagement in higher education by linking inquiry directly with professional practice. In particular, the literature emphasizes its potential for reducing the gap between theory and practice, supporting continuous reflection, and involving teachers in the systematic analysis and transformation of their own educational activity (Baidildinova et al., 2022; Berikkhanova et al., 2023a, b; Rizakhodjayeva et al., 2022).

At the conceptual level, these studies associate Action Research with activity-based and synergistic approaches, as well as with principles of proactivity, self-reflection, continuity, and collaboration among participants in the educational process (Berikkhanova et al., 2023a, b). Related forms of practice-oriented inquiry, such as Lesson Study, are also discussed as relevant mechanisms for enhancing research activity through collaborative work in real educational settings (Maigeldiyeva et al., 2021). Overall, the Kazakhstani literature positions Action

TABLE 1 Key categories and concepts identified within the thematic blocks of the systematic review.

Blocks of Meaning	Key categories and concepts
Block 1: Research approaches, technologies and methods	• In-formal education; • integration of research and practice; • the pedagogy of learning to innovate, collaborate and co-create; • learning analytics; • Problem-Based Learning (PBL); • Project-based learning (PBL); • Project-based blended learning (BPBL); • Scrum approach
Block 2: Research Competencies of Teachers	• scientific literacy; • experimental (research) culture; • "pedagogical weakness"; • widening participation (WP) practices; • transformational learning; • proactive learning; • researcher-practitioner; • teacher-researcher; • teacher self-efficacy; • collaborative teamwork
Block 3: Strategies and research approaches in teacher education	• A model of teaching effectiveness; • the attitudes of an enthusiastic teacher; • enquiry-based strategy (EBS); • research-based pedagogy; • integration of pedagogical practice with educational theory; • Content-based collaborative research; • Design-based professional learning (DBPL).
Block 4: Student involvement in research	• learner engagement; • research skills; • scientific literacy; • accommodator - learner through concrete experience and active experimentation; • divergent - learner through concrete experience and reflective observation; • assimilator - learning through abstract conceptualization and reflective observation; • convergent - learning through abstract conceptualization and active experimentation; • "open research"; • Undergraduate Research (UR)

Research as an increasingly significant non-formal methodology for strengthening research-oriented teacher education.

3.2.2 Block 2: formation of research activity of future teachers

The reviewed Kazakhstani studies show that the formation of research competence begins at the stage of university education

through the active involvement of students in research activity. At the same time, the literature indicates that young teachers often experience difficulties in conducting research, which points to the need for stronger support systems and greater immersion in real professional contexts during initial teacher preparation (Kariyev et al., 2023). The relevance of developing students' research competence is framed both globally, in relation to Kazakhstan's integration into the international educational space, and locally, in terms of strengthening motivational, cognitive, creative, and operational components of professional development (Sarsembaeva, 2022).

Research culture is interpreted in this literature as an integrative and dynamic quality that includes value-based orientation toward inquiry, methodological and reflexive knowledge, and developed research skills. In this context, the formation of future teachers' research activity is closely linked to professionally important qualities, especially communicative competence and readiness for collaborative problem-solving in real educational settings (Buribayev et al., 2023). The studies also emphasize the importance of building a corporate research culture that encourages active team-based inquiry both during university study and in subsequent professional practice (Toktarbekova, 2021).

3.2.3 Block 3: research competence of the teacher

Research competence is considered as the ability to solve research problems, conscious readiness to engage in research activities. Research competence is characterized by integrity, interactivity, dynamism (Bayalina and Damekova, 2020).

Research competence allows to create qualitative changes in the sphere of professional activity of a teacher (Kdyrbayeva et al., 2020).

3.2.4 Block 4: project methods for developing research activity

A significant number of studies are devoted to the analysis of the practice of applying project methods in the development of research skills of teachers of preschool organizations. They note the active adaptation of this innovative technology in the pedagogical process of higher education institutions. The authors name technologies and methods themselves, aspects of education management, innovative pedagogical activities, educational process and the education system as a whole as the subject of research in the framework of projects (Serkan Kelesuglu et al., 2023).

The importance of mastering project technology lies in the fact that it allows predicting personal and organizational changes in the teacher's activity under the condition of unity of implementation of problem and empirical components of the research, which will ultimately ensure its objectivity, reproducibility, evidence and accuracy (Mamytbayeva et al., 2022). The importance of focusing on improving education by involving educators in project-based research activities and their commercialization is also emphasized (Kenzhaliyev et al., 2021).

3.3 Comparative synthesis of international and kazakhstani literature

The comparative analysis showed that both international and Kazakhstani literature recognize the importance of strengthening research activity in teacher education; however, they differ substantially in conceptual orientation, methodological diversity, and analytical depth.

First, the international literature more frequently conceptualizes research activity as a reflective, inquiry-based, and practice-embedded dimension of teacher education. Research is treated as part of teachers' professional identity and as a mechanism for understanding and transforming pedagogical practice. By contrast, the Kazakhstani literature more often frames research activity as a strategic educational priority linked to the modernization of higher pedagogical education and the strengthening of research competence within institutional reform.

Second, the methodological structure of the two corpora differs considerably. The international corpus contains a broader range of intervention-based and practice-oriented approaches, including enquiry-based learning, design-based professional learning, collaborative inquiry, and Action Research. These approaches are often discussed in relation to authentic learning environments, teacher agency, and the integration of theory with practice. The Kazakhstani corpus, while increasingly attentive to Action Research, Lesson Study, and project-based methods, more commonly emphasizes conceptual justification, competence formation, and the strategic significance of research-oriented teacher education, rather than the detailed analysis of implementation processes.

Third, the comparison revealed a difference in analytical emphasis. The international literature tends to offer stronger interpretive synthesis of how and why specific methodologies contribute to teacher development. The Kazakhstani literature, in contrast, more often highlights what should be developed and why it matters, but less frequently demonstrates how these approaches operate in sustained pedagogical contexts. This suggests that the methodological discourse in Kazakhstan is still consolidating and has significant potential for further empirical and analytical elaboration.

At the same time, both corpora share several important priorities. They emphasize the need to integrate research with pedagogical practice, to strengthen reflective capacity, and to create conditions under which teachers and students can participate more actively in inquiry processes. These commonalities indicate that research-oriented teacher education is a shared educational priority, even though the conceptual pathways and institutional conditions differ.

Within this broader comparative framework, Action Research emerges as an important methodology because it connects reflection, inquiry, and professional change within authentic educational contexts. However, the review also indicates that its significance should be understood alongside other research-oriented approaches rather than as an exclusive or universally dominant model.

4 Discussion

The findings of this review suggest that research-oriented teacher education should be understood not merely as the

acquisition of research techniques, but as the development of a reflective, inquiry-based, and professionally agentic position. This interpretation is especially visible in the international literature, where research activity is embedded in collaborative inquiry, pedagogical experimentation, and authentic professional contexts. In this sense, research-oriented approaches do not simply supplement teacher education; they redefine it as a space in which teaching, reflection, and knowledge production become closely interconnected.

The attitude to research ensures the productivity of higher education teacher's activity, the ability to respond flexibly to the ongoing changes. At the same time, it is important to correctly understand one's own capabilities and resources of the educational process. The Organization for Economic Cooperation and Development (OECD) aims education to develop in a rapidly changing world with increasing uncertainty, which requires the development of competencies that allow the teacher to quickly restructure the educational process, flexibly responding to the challenges of the time (OECD, 2019).

The Kazakhstani literature demonstrates growing recognition of the same agenda, particularly in relation to the modernization of higher pedagogical education and the strengthening of research competence. However, the comparative synthesis also reveals a gap between strategic recognition and methodological elaboration. Many Kazakhstani studies persuasively justify the importance of research activity, but fewer provide analytically robust or empirically grounded models showing how research-oriented approaches are implemented in sustained pedagogical practice. This indicates that the development of research-oriented teacher education in Kazakhstan would benefit not only from conceptual support, but also from stronger methodological design and deeper comparative evidence.

The review also clarifies the place of Action Research within the contemporary methodological landscape of teacher education. Its significance lies in its ability to connect professional reflection, inquiry into practice, and context-sensitive pedagogical change. At the same time, the present review does not support treating Action Research as the only or universally superior model. Rather, it should be understood as one important approach within a wider methodological repertoire that also includes enquiry-based, project-based, design-based, and collaborative research-oriented formats. Its educational value depends on institutional support, methodological preparation, collegial culture, and the readiness of teachers to engage in reflective inquiry.

This broader interpretation is important for avoiding an overly normative reading of the literature. The review shows that no single methodology functions effectively in all contexts. What appears more important is the degree to which a given approach enables teachers to investigate meaningful pedagogical problems, connect evidence with practice, and participate in professional learning processes that are both reflective and contextually grounded.

Teacher research is increasingly viewed as an essential form of independent professional inquiry that enables the systematic analysis of pedagogical problems and the continuous improvement of educational practice. In this respect, the second mission of higher education - alongside the preparation of qualified specialists - also includes the production of scientific knowledge, the quality of which depends not only on institutional conditions but also on the competencies of

individual researchers (Mukhatayev et al., 2024). Against this background, growing attention is being paid to non-formal methods of activating teachers' research activity, particularly those that move beyond classical educational research and integrate both qualitative and quantitative approaches. Rubia-Avi (2023) argues that although teachers may be experts in their disciplines, they often have limited experience in research and assessment, which makes approaches such as learning analytics especially relevant for linking evidence, innovation, and educational improvement. Bovill (2020), in turn, emphasizes that non-formal pedagogy is grounded in sustained teacher-student relationships, which are essential for collaborative learning and the co-construction of knowledge.

In light of contemporary global educational trends, several research directions have become especially significant for the development of research-oriented teacher education. These include collaborative pedagogical research within networked professional communities aimed at equitable and sustainable educational development (Hosein and Rao, 2025; Setyaningrum and Jamilah, 2025), participatory action research as a flexible and reflexive practice-oriented methodology (Feekey, 2023), and student engagement in applied educational research to improve teaching and learning materials (Afrilyasanti et al., 2024; Martinez-Vargas et al., 2024). Additional attention has been given to online action research in digital learning environments (Arthur and Feldman, 2024), teacher empowerment and the prevention of de-professionalization through action research (Crawford, 2025), and critical studies of the transformative influence of innovative technologies on learning (Mena-Guacas et al., 2025).

The reviewed literature also confirms the importance of practically implementing informal research methods as an effective mechanism for improving and transforming educational practice. This orientation is consistent with the principles of practice-based inquiry and evidence-informed education, as it reinforces the connection between research and everyday teaching practice. In this regard, Wilson's typology of practice-oriented non-formal research is useful for positioning Action Research within a broader family of inquiry approaches rather than treating it as an isolated model (Wilson, 2017).

As shown in Table 2, Action Research is characterized by strong proximity to professional practice, practitioner involvement, and cyclical reflective processes. At the same time, the comparison makes clear that it is one of several formats through which research-oriented professional learning can be organized. This supports the conclusion that its value lies not in methodological exclusivity, but in its contextual and pedagogical fit.

The review findings are also relevant for current reforms in Kazakhstani teacher education, where there is growing interest in strengthening research competence through practice-based and inquiry-oriented formats. In this respect, the comparative evidence synthesized in this review may inform the further development of curricular and professional learning initiatives in higher pedagogical education.

As shown in Table 2, Action Research is characterized by strong proximity to professional practice, practitioner involvement, and cyclical reflective processes. In the Kazakhstani context, this approach is gaining increasing relevance as part of the broader effort to strengthen research-oriented teacher education. Its integration into the educational landscape has been supported

TABLE 2 Typology of practice-oriented non-formal research approaches (adapted from Wilson, 2017).

Key question	Design-driven research	Action Research	Lesson Study	Training work
Who determines the focus of the research?	Mainly university researchers	Practitioners	Team of practitioners	Team of practitioners
Who is involved in the collaboration?	A team of researchers and practitioners	Practitioner team	Team of practitioners	Team of practitioners
What types of knowledge are generated?	Theoretical knowledge of practice setting	More emphasis on practical knowledge and theoretical knowledge as needed	More practical knowledge with a focus on students	Practical knowledge, Basic concepts of learning theory, didactics
What is the duration of the research?	Can last months or years depending on the purpose of the project?	Reflexive cyclical spiraling process that can last months or a year depending on the purpose of the project	More than one lesson, a series of lessons	More than one lesson, series of lessons
Where is this research being conducted?	Fieldwork conducted by the researcher in a practical setting.	In a training environment		

through professional development initiatives, training formats, and the creation of institutional conditions for practice-based inquiry. Evidence from the implementation of an Action Research training course at Abai Kazakh National Pedagogical University further indicates a high level of interest among young researchers and teachers, increased motivation for research activity, and growing readiness to apply Action Research in professional practice. Participants also emphasized the need for continued methodological support, access to research resources, mentoring, and institutional recognition of practice-based research. Taken together, these observations suggest that the value of Action Research lies not only in its methodological logic, but also in its capacity to support sustainable professional learning when embedded in an enabling institutional environment.

The review findings are also relevant for current reforms in Kazakhstani teacher education, where there is growing interest in strengthening research competence through practice-based and inquiry-oriented formats. In this respect, the comparative evidence synthesized in this review may inform the further development of curricular and professional learning initiatives in higher pedagogical education.

5 Conclusion

This study provided a systematic comparative review of international and Kazakhstani literature on research methodologies in teacher education. The review showed that both contexts recognize the importance of strengthening research activity; however, they differ in conceptual orientation, methodological diversity, and analytical emphasis. International literature more often frames research activity as reflective, inquiry-based, and practice-oriented, whereas Kazakhstani studies more frequently approach it as a strategic and institutional priority linked to the modernization of pedagogical education. Within this broader landscape, Action Research emerged as an important methodology for connecting reflection, inquiry, and professional change, although its value should be understood in relation to other research-oriented approaches rather than as a single dominant model.

The findings of the review also have practical significance for the further development of teacher education in Kazakhstan. They suggest the need for a more systematic institutionalization of Action Research and other forms of non-formal research in higher education through curricular integration, workload recognition, expert and methodological support, and more favorable conditions for dissemination and funding of practice-based research. In this respect, the relevance of these recommendations is reinforced by the fact that processes of institutionalizing non-formal research are already beginning to take shape at Abai Kazakh National Pedagogical University and other universities in Kazakhstan. Thus, the study not only identifies methodological trends and gaps, but also provides an analytical foundation for strengthening research-oriented pedagogical education in ways that are both context-sensitive and practically applicable.

6 Research limitations

This review has several limitations. First, the international corpus was limited to publications identified within the selected Scopus-indexed source, while the Kazakhstani corpus was limited to journals recommended by the national quality assurance system and available in digital form. Second, the terminology used to describe research activity, research competence, and research-oriented pedagogy varies considerably across contexts, which may have affected comparability. Third, the included studies differed in methodological design, scope, and analytical depth, making direct comparison challenging. These limitations should be taken into account when interpreting the findings and identifying directions for future research.

7 Conclusions for further research

Future studies may extend the present review by expanding the database coverage, incorporating a broader range of international and regional sources, and examining how research-

oriented approaches are implemented empirically in teacher education programs. Particular attention should be given to longitudinal and intervention-based studies capable of demonstrating how reflective and inquiry-based methodologies influence teachers' professional learning in specific institutional contexts.

Author contributions

AB: Writing – review & editing, Methodology, Funding acquisition, Investigation, Conceptualization, Project administration, Validation. FA: Conceptualization, Writing – review & editing, Methodology, Writing – original draft, Resources. LS: Supervision, Formal analysis, Methodology, Writing – review & editing, Writing – original draft, Data curation, Investigation, Software. ZI: Funding acquisition, Visualization, Resources, Writing – original draft. GB: Supervision, Writing – original draft, Visualization, Validation. KM: Writing – original draft, Visualization, Validation, Methodology.

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References

- Acton, R. (2019). Mapping the evaluation of problem-oriented pedagogies in higher education: a systematic literature review. *Educ. Sci.* 9 (4), 269. doi: 10.3390/educsci9040269
- Afrilyasanti, R., Basthomi, Y., and Suhartoyo, E. (2024). Involving students as collaborators in developing learning materials through action research. *Educ. Action Res.* 33 (2), 251–273. doi: 10.1080/09650792.2024.2307566
- Alamri, M. M. (2021). Using blended project-based learning for students' behavioral intention to use and academic achievement in higher education. *Educ. Sci.* 11 (5), 207. doi: 10.3390/educsci11050207
- Androutsos, A., and Brinia, V. (2019). Developing and piloting a pedagogy for teaching innovation, collaboration, and co-creation in secondary education based on design thinking, digital transformation, and entrepreneurship. *Educ. Sci.* 9 (2), 113. doi: 10.3390/educsci9020113
- Aragón, L., and Gómez-Chacón, B. (2022). Promoting enquiry skills in trainee teachers within the context of the university ecological garden. *Educ. Sci.* 12 (3), 214. doi: 10.3390/educsci12030214
- Arthur, S. A., and Feldman, A. (2024). A study of the teaching of action research in an online setting. *Educ. Action Res.* 33 (3), 472–490. doi: 10.1080/09650792.2024.2336038
- Baidildinova, D. K., Sarsenbayeva, L. O., and Asilbayeva, F. B. (2022). Improvement of research activity of teachers on the basis of action research approach. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 3 (75), 119–135. doi: 10.51889/5783.2022.90.64.010
- Baines, M., and Gregson, M. (2020). Reflections of a practitioner-researcher in the field of widening participation in arts education. *Educ. Sci.* 10 (5), 133. doi: 10.3390/educsci10050133
- Bayalina, A. M., and Damekova, S. K. (2020). The essence and structure of research competence of the teacher of mathematics. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 68 (4), 137–143. doi: 10.51889/2020-4.1728-5496.21
- Berikhanova, A., Sarsenbayeva, L., Sapargaliyeva, B., and Ibraimova, Z. (2023). Methodological approach and principles of research activity development of university teachers based on action research. *Pedag. Psychol.* 3 (56), 48–55. doi: 10.51889/2960-1649.2023.15.3.005
- Berikhanova, A., Sapargaliyeva, B., Ibraimova, Z., Sarsenbayeva, L., Asilbayeva, F., Baidildinova, D., et al. (2023a). Conceptualising the integration of action research into the practice of teacher education universities in Kazakhstan. *Educ. Sci.* 13 (10), 1034. doi: 10.3390/educsci13101034
- Berikhanova, A., Sapargaliyeva, B., Sarsenbayeva, L., and Asilbayeva, F. (2023b). Analysis of world practices of action research implementation in the system of higher education. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 79 (3), 24–36. doi: 10.51889/2959-5762.2023.79.3.003
- Bovill, C. (2020). *Co-creating learning and teaching: Towards relational pedagogy in higher education*. Abingdon, UK/New York, NY: Routledge (Accessed May 2, 2026)
- Brown, B., Friesen, S., Beck, J., and Roberts, V. (2020). Supporting new teachers as designers of learning. *Educ. Sci.* 10 (8), 207. doi: 10.3390/educsci10080207
- Brundiers, K., and Wiek, A. (2017). Beyond interpersonal competence: teaching and learning professional skills in sustainability. *Educ. Sci.* 7 (1), 39. doi: 10.3390/educsci7010039
- Buribayev, D., Bakhtiyarova, G., and Olkhovaya, T. (2023). Professional qualities as a condition for the development of research culture of the future teacher of primary classes. *Bull. L. N. Gumilev Eur. Natl. Univ., Ser. Pedagog. Psychol. Sociol.* 142 (1), 168–177. doi: 10.32523/2616-6895-2023-142-1-168-177
- Calvert, L. (2016). *Moving from compliance to agency: What teachers need to make professional Earning Work*. Arlington, VA: Learning Forward and NCTAF (Accessed May 2, 2026)
- Concept for the development of higher education and science in the Republic of Kazakhstan for 2023–2029. (2023). Approved by the Resolution of the Government of the Republic of Kazakhstan No. 248. Available online at: <https://cis-legislation.com/document.fwx?rgn=149264>
- Crawford, R. (2025). Responding to the de-professionalisation of teaching: empowering teachers to enhance their pedagogy through action research. *Educ. Sci.* 15 (3), 274. doi: 10.3390/educsci15030274
- Cunningham, D. (1993). *Action Research and Organizational Development*. London: Bloomsbury Academic. Available online at: [https://www.scrip.org/\(S\(i43dyn45teexjx-455qlt3d2q\)\)/reference/referencespapers?referenceid=3194129](https://www.scrip.org/(S(i43dyn45teexjx-455qlt3d2q))/reference/referencespapers?referenceid=3194129) (Accessed May 2, 2026)
- Darling-Hammond, L., Burns, D., Campbell, C., Goodwin, A., Hammerness, K., Low, E.-L., et al. (2017). *Empowered educators: How high performing systems shape teaching around the world*. Wiley. https://www.researchgate.net/publication/319534035_

Conflict of interest

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Denzin, N. K., and Lincoln, Y. S. (2011). *The SAGE Handbook of Qualitative Research* (4th ed.). Thousand Oaks, CA: Sage Publications. Available online at: <https://www.scrip.org/reference/referencespapers?referenceid=1854377> (Accessed May 2, 2026)

Drumond Vieira, R., Florentino de Melo, V., Avraamidou, L., and Avelar Lobato, J. (2017). Reconceptualizing scientific literacy: The role of students' epistemological profiles. *Educ. Sci.*, 7 (2), 47.

Edmondson, A. (2012). *Teaming: How Organizations Learn, Innovate, and Compete in the Knowledge Economy*. San Francisco, CA: Jossey-Bass. Available online at: <https://www.scrip.org/reference/referencespapers?referenceid=2823670> (Accessed May 2, 2026)

Feekery, A. (2023). The 7 c's framework for participatory action research: inducting novice participant-researchers. *Educ. Action Res.* 32 (3), 332–347. doi: 10.1080/09650792.2023.2234417

Gachago, D., Morkel, J., Hitge, L., van Zyl, I., and Ivala, E. (2017). Developing e-learning champions: a design thinking approach. *Int. J. Educ. Technol. High. Educ.* 14 (30), 91–106. doi: 10.1186/s41239-017-0068-8

Glesne, C., and Peshkin, A. (1992). *Becoming Qualitative Researchers: An introduction*. White Plains, NY: Longman. Available online at: <https://sedl.org/pubs/pic02/picbib-output.cgi?searchuniqueid=16> (Accessed May 2, 2026)

Hacisalihoglu, G., Stephens, D., Stephens, S., Johnson, L., and Edington, M. (2020). Enhancing undergraduate student success in STEM fields through growth mindset and grit. *Educ. Sci.* 10 (10), 279. doi: 10.3390/educsci10100279

Hattie, J., and Zierer, K. (2017). *Mindframes for Visible Learning: Teaching for Success*. London: Routledge. doi: 10.4324/9781315206387

Hendricks, C. (2012). *Improving Schools Through Action Research: A Reflective Practice Approach* (4th ed.). Boston, MA: Pearson. Available online at: https://www.academia.edu/63759092/Improving_Schools_Through_Action_Research_A_Reflective_Practice_Approach (Accessed May 2, 2026)

Hosein, A., and Rao, N. (2025). Moving beyond personal teaching theories: creating collaborative praxis models through action research. *Educ. Action Res.*, 1–17. doi: 10.1080/09650792.2025.2541919

Howard, P. G. (2018). Twenty-first century learning as a radical re-thinking of education in the service of life. *Educ. Sci.* 8 (4), 189. doi: 10.3390/educsci8040189

Jaiswal, A., Karabiyik, A. T., Thomas, P., and Magana, A. J. (2021). Characterizing team orientations and academic performance in cooperative project-based learning environments. *Educ. Sci.* 11 (9), 520. doi: 10.3390/educsci11090520

Kariyev, A., Abykanova, B., and Tautenbayeva, A. (2023). Professionalism of university teachers: concept, components, stages of development. *Bull. L. N. Gumil. Eurasian Natl. Univ., Ser. Pedagog. Psychol. Sociol.* 142 (1), 131–141. doi: 10.32523/2616-6895-2023-142-1-131-141

Kdyrbayeva, A.A., Ryabova, E.V., and Stambekova, A.S. (2020). Improving the quality of education through the development of research competence of the teacher. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 3 (67), 16–22. doi: 10.51889/2020-3.1728-5496.02

Kenzhaliyev, O., Kassymova, G., Tsekhoovoy, A., and Ilmaliyev, Z. (2021). Problems of research and education development in Kazakhstan. *Pedagog. Psychol.* 3 (48), 5–13. doi: 10.51889/2021-3.2077-6861.01

Ketelhut, D. J., Nelson, B., Schifter, C., and Kim, Y. (2023). Improving science assessments by situating them in a virtual environment. *Educ. Sci.* 3 (2), 172–192. doi: 10.3390/educsci3020172

Kinchin, I. M. (2019). The salutogenic management of pedagogic frailty: a case of educational theory development using concept mapping. *Educ. Sci.* 9 (2), 157. doi: 10.3390/educsci9020157

Kultaeva, S. S., Kim, O. Y., Userbaeva, M. M., and Kim, E. S. (2023). Distinctive features of the U.S. Higher education system under globalization. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 2 (77), 44–51. doi: 10.51889/5768.2022.25.14.004

Laidlaw, A. H., Aiton, J. F., Struthers, J., and Guild, S. (2012). Developing research skills in medical students: aMEE guide No. 69. *Med. Teach.* 34 (9), 754–771. doi: 10.3109/0142159X.2012.704438

Laurillard, D. (2018). Teaching as a design science: teachers building, testing, and sharing pedagogic ideas. In *Second Handbook of information technology in primary and secondary education*, eds. J. Voogt, G. Knezek, R. Christensen, and K. W. Lai (Cham: Springer), 557–566. Springer. doi: 10.1007/978-3-319-71054-9_108

Leach, M., Scoones, I., and Stirling, A. (2010). *Dynamic sustainabilities: technology, environment, social justice*. Taylor & Francis. doi: 10.4324/9781849775069

Lira, L. A. N., Carrión, C. E. G., Loayza, M. G. B., Alviar, R. A. S., Del Alviar, O. C. S., and Miñan, V.A.A. (2022). The digital scenarios of research in university higher education. *J. Posit. Sch. Psychol.* 6, 1743–1754.

Loo, R. (2022). A meta-analytic examination of Kolb's learning style preferences among business majors. *J. Educ. Bus.* 77 (4), 252–256. doi: 10.1080/08832320209599673

Maigeldiyeva, J. M., Kurmanbayev, R. H., and Koyanbayeva, U. B. (2021). From the experience of lesson study implementation in the educational process of higher

education institutions. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 69 (1), 36–48. doi: 10.51889/2021-1.1728-5496.05

Maltese, A., Harsh, J., and Jung, E. (2017). Evaluating undergraduate research experiences: development of a self-report tool. *Educ. Sci.* 7 (4), 87. doi: 10.3390/educsci7040087

Mamytybayeva, J., Toleshova, U., and Boranbaeva, A. (2022). The essence of pedagogical psychology of the concept of research activity in the project training of teachers. *Pedagog. Psychol.* 53 (4), 5–15. doi: 10.51889/5418.2022.31.77.007 (Accessed May 2, 2026)

Martinez-Vargas, C., Mathebula, M., Cin, F. M., and Mkwanzani, F. (2024). Working as facilitators and co-researchers: opportunities, tensions and complexities in educational participatory research. *Educ. Action Res.* 33 (3), 438–453. doi: 10.1080/09650792.2024.2342824

Matos, J. F., Piedade, J., Freitas, A., Pedro, N., Dorotea, N., Pedro, A., et al. (2023). Teaching and learning research methodologies in education: a systematic literature review. *Educ. Sci.* 13 (2), 173. doi: 10.3390/educsci13020173

Mena-Guacas, A. F., López-Catalán, L., Bernal-Bravo, C., and Ballesteros-Regaña, C. (2025). Educational transformation through emerging technologies: critical review of scientific impact on learning. *Educ. Sci.* 15, 368. doi: 10.3390/educsci15030368

Molina-Torres, M. R. (2022). Project-based learning for teacher training in primary education. *Educ. Sci.* 12 (10), 647. doi: 10.3390/educsci12100647

Mukhatayev, A., Omirbayev, S., Kassenov, K., and Idiyatova, Y. (2024). Quality assurance system of higher education in Kazakhstan through stakeholders' eyes: an empirical study to identify its challenges. *Educ. Sci.* 14 (12), 1297. doi: 10.3390/educsci14121297

Ngereja, B., Hussein, B., and Andersen, B. (2020). Does project-based learning (PBL) promote student learning? A performance evaluation. *Educ. Sci.* 10 (11), 330. doi: 10.3390/educsci10110330

OECD (2019). The future of education and skills 2030: The OECD learning compass 2030 (Concept Note Series). Available online at: https://www.oecd.org/content/dam/oecd/en/about/projects/edu/education-2040/1-1-learning-compass/OECD_Learning_Compass_2030_Concept_Note_Series.pdf (Accessed May 2, 2026)

O'Toole, J. M., McKoy, K., Freestone, M., and Osborn, J. A. (2020). 'Scientific literacy': an exercise in model building. *Educ. Sci.* 10 (8), 204. doi: 10.3390/educsci10080204

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Br. Med. J.* 372, n71. doi: 10.1136/bmj.n71

Palmu, T. H. (1998). Koulun salin monet kasvat. *Nuorisotutkimus* 16 (1), 12–18.

Pološki Vokić, N., and Aleksić, A. (2020). Are active teaching methods suitable for all generation Y students? Creativity as a needed ingredient and the role of learning style. *Educ. Sci.* 10 (4), 87. doi: 10.3390/educsci10040087

Rizakhodjayeva, G., Akeshova, M., and Yusupova, G. (2022). Modernization of master's program based on the research project in action: problems of theory and practice of academic skills development. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 73 (4), 30–40. doi: 10.26577/JES.2022.v73.i4.03

Rodríguez Jiménez, C., Sanz Prieto, M., and Alonso García, S. (2019). Technology and higher education: a bibliometric analysis. *Educ. Sci.* 9 (3), 169. doi: 10.3390/educsci9030169

Rubia-Avi, B. (2023). The research of educational innovation: perspective and strategies. *Educ. Sci.* 13 (1), 26. doi: 10.3390/educsci13010026

Sarsembaeva, K. E. (2022). Theoretical bases of formation of research competence of students of non-pedagogical universities. *Bull. L. N. Gumil. Eurasian Natl. Univ., Ser. Pedagog. Psychol. Sociol.* 1 (138), 364–373. doi: 10.32523/2616-6895-2022-138-1-364-374

Savery, J. R. (2006). Overview of problem-based learning: definitions and distinctions. *Interdiscip. J. Problem-Based Learn.* 1 (1), 8–20. doi: 10.7771/1541-5015.1002

Sánchez-Cabrero, R., Estrada-Chichón, J. L., Abad-Mancheño, A., and Mañoso-Pacheco, L. (2021). Models on teaching effectiveness in current scientific literature. *Educ. Sci.* 11 (8), 409. doi: 10.3390/educsci11080409

Serkan Kelesuglu, S., Mamytybayeva, J. A., and Serzhanyly, B. (2023). Development of research activity of future teachers of preschool organizations with the help of design technology and training content. *Bull. Abai KazNPU, Ser. Pedagog. Sci.* 4 (76), 106–115. doi: 10.51889/9197.2022.53.76.011

Setyaningrum, A., and Jamilah (2025). "Empowering teachers for equitable and sustainable education: action research, teacher agency, and online community [review of the book empowering teachers for equitable and sustainable education," in *Educational Action Research*, eds. M. T. Tatto, and L. Brown (Abingdon: Routledge), 1–3. doi: 10.1080/09650792.2025.2566055

Shah, D. B., and Bhattarai, P. C. (2023). Factors contributing to teachers' self-efficacy: a case of Nepal. *Educ. Sci.* 13 (1), 91. doi: 10.3390/educsci13010091

Sousa, M. J., Suleman, F., Melé, P. M., and Gómez, J. M. (2021). New research and trends in higher education. *Educ. Sci.* 11 (9), 456. doi: 10.3390/educsci11090456

St. John, E. P. (2023). Higher education in post-neoliberal times: building human capabilities in the emergent period of uncertainty. *Educ. Sci.* 13 (5), 500. doi: 10.3390/educsci13050500

- Sterling, S. (2010). Transformative learning and sustainability: sketching the conceptual ground. *Learn. Teach. High. Educ.* 24, 17–33. Available online at: https://www.researchgate.net/publication/266184629_Transformative_Learning_and_Sustainability_Sketching_the_Conceptual_Ground (Accessed May 2, 2026)
- Timperley, H. S. (2011). *Realizing the Power of Professional Learning*. Maidenhead: Open University Press/McGraw-Hill Education. Available online at: <https://www.scrip.org/reference/referencespapers?referenceid=2290708>
- Tirri, K. (2021). Contemporary teacher education: a global perspective—introduction to a special collection of research. *Educ. Sci.* 11 (7), 340. doi: 10.3390/educsci11070340
- Toktarbekova, Z. N. (2021). Theoretical model of formation conditions of corporate research culture of future education psychologist. *Bull. L. N. Gumil. Eurasian Natl. Univ., Ser. Pedagog. Psychol. Sociol.* 2 (135), 191–201. doi: 10.32523/2616-6895-2021-135-2-191-201
- Tomaszewski, W., Xiang, N., Huang, Y., Western, M., McCourt, B., and McCarthy, I. (2022). The impact of effective teaching practices on academic achievement when mediated by student engagement: evidence from Australian high schools. *Educ. Sci.* 12 (5), 358. doi: 10.3390/educsci12050358
- Townley, A. L. (2018). Teaching and learning science in the 21st century: challenging critical assumptions in post-secondary science. *Educ. Sci.* 8 (1), 12. doi: 10.3390/educsci8010012
- Vázquez-Villegas, P., Mejía-Manzano, L. A., Sánchez-Rangel, J. C., and Membrillo-Hernández, J. (2023). Scientific method's application contexts for the development and evaluation of research skills in higher-education learners. *Educ. Sci.* 13 (1), 62. doi: 10.3390/educsci13010062
- Voogt, J., Laferrière, T., Breuleux, A., Itow, R. C., Hickey, D. T., and McKenney, S. (2015). Collaborative design as a form of professional development. *Instr. Sci.* 43 (2), 259–282. doi: 10.1007/s11251-014-9340-7
- West, M. A. (2012). *Effective Teamwork: Practical Lessons from Organizational Research* (3rd ed.). Oxford: Wiley-Blackwell. Available online at: <https://www.scrip.org/reference/referencespapers?referenceid=1393995> (Accessed May 2, 2026)
- Wilson, E. (2017). *Alternative Paths to Upgrading Existing Teacher Qualifications: The Kazakhstan-based Centre of Excellence Teacher Education Programme*. Cambridge: Cambridge University Press. Available online at: https://www.academia.edu/28281086/Alternative_paths_to_upgrading_existing_teacher_qualifications_the_Kazakhstan_based_Centre_of_Excellence_Teacher_Education_Programme (Accessed May 2, 2026)
- Wolff, L. A., Sjöblom, P., Hofman-Bergholm, M., and Palmberg, I. (2017). High performance education fails in sustainability? A reflection on Finnish primary teacher education. *Educ. Sci.* 7 (1), 32. doi: 10.3390/educsci7010032