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STUDENT TEACHERS AS RESEARCHERS: A CONCEPTUAL FRAMEWORK FOR PROFESSIONAL IDENTITY, COMPETENCE DEVELOPMENT, AND DIGITAL MEDIATION

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ABSTRAKT

Táto teoretická štúdia skúma úlohu výskumu realizovaného študentmi vo vzdelávaní učiteľov z hľadiska profesionálnej identity, rozvoja kompetencií a digitálnej mediácie. Vychádzajúc z tradície „učiteľ ako výskumník“ a zo súčasnej odbornej literatúry o bádateľsky orientovanom vzdelávaní učiteľov, štúdia syntetizuje medzinárodné poznatky do dvojitého konceptuálneho rámca. Lineárny model zobrazuje výskum ako rozvojovú dráhu smerujúcu k rozvoju kompetencií, formovaniu identity a profesionalizácii, zatiaľ čo špirálový model zachytáva rekurzívny, identitou riadený a celoživotný charakter profesionálneho rastu. Rámec zvýrazňuje identitu ako kľúčový mechanizmus udržateľnosti a digitálny výskum ako transformačný kontext.

Keywords: *učiteľ ako výskumník, profesionálna identita, rozvoj kompetencií, bádateľsky orientované vzdelávanie učiteľov, digitálna pedagogika, profesionalizácia učiteľov, konceptuálny model*

ABSTRACT

This theoretical study examines the role of student research in teacher education through the lenses of professional identity, competence development, and digital mediation. Drawing on the teacher-as-researcher tradition and contemporary scholarship on inquiry-based teacher education, the paper synthesizes international literature into a dual conceptual framework. A linear model depicts research as a developmental pathway toward competence, identity formation, and professionalization, while a spiral model captures the recursive, identity-driven, and lifelong nature of professional growth. The framework highlights identity as the key mechanism of sustainability and digital inquiry as a transformative context.

Keywords: *teacher as researcher, professional identity, competence development, inquiry-based teacher education, digital pedagogy, teacher professionalization, conceptual model*

Main work

Introduction

Teacher education increasingly emphasizes inquiry, reflection, and evidence-informed practice as core elements of teacher professionalism. In this context, student research has become a common component of initial teacher education, appearing in the form of action research projects, inquiry-based coursework, research-informed practica, and thesis requirements.

Despite its growing presence, however, the role of student research in long-term teacher professional development remains insufficiently theorized.

Existing studies document multiple benefits of practitioner inquiry, including enhanced reflection, pedagogical understanding, and research literacy. Yet this literature shows several limitations. It often focuses on short-term competence development, treats research as a relatively uniform activity, and gives limited attention to professional identity as a central explanatory mechanism. As a result, the processes through which student research contributes to sustained professionalization remain fragmented. At the same time, teacher education is increasingly embedded in digitally mediated environments. Digital tools and platforms are reshaping how inquiry is conducted, how evidence is produced and shared, and how professional roles and identities are negotiated, yet the digital dimension of student research is frequently treated as merely instrumental.

This paper addresses these gaps by synthesizing research on student teachers as researchers, professional identity formation, competence development, and digital pedagogy into a coherent conceptual framework. It argues that student research should be understood not simply as a methodological exercise, but as a key mechanism through which competences are developed, professional identity is formed, and professionalization is sustained.

To capture both the directional and dynamic aspects of this process, the paper proposes a dual conceptual framework. A linear model depicts student research as a developmental pathway leading to competence development, identity formation, and professionalization. Complementing this, a spiral model conceptualizes professional growth as a recursive, identity-driven, and lifelong process in which inquiry functions as a stance rather than a discrete phase. By placing professional identity at the centre of the framework, integrating competence development with identity formation, and foregrounding digital mediation, the paper offers a theoretically grounded account of research-based teacher education. It provides a basis for longitudinal and context-sensitive empirical research and informs the design of inquiry-oriented teacher education programs. The paper concludes by presenting the conceptual model and discussing its implications for research, practice, and policy.

1. Teacher as researcher – origins and theoretical roots

1.1 Early foundations: reflection, action, and curriculum inquiry

The idea of teachers as researchers emerged in early twentieth-century progressive education. John Dewey (1998) argued that reflective thought lies at the heart of intelligent action, positioning teaching as inquiry rather than routine application. Teachers, in this view, generate knowledge by working through real problems in real contexts.

At the same time, Kurt Lewin (1946) developed action research as a cyclical process of planning, acting, observing, and reflecting, explicitly linking inquiry to participation and social change.

These ideas converged in postwar curriculum reform, particularly in the UK. Projects such as the Ford Teaching Project and the Humanities Curriculum Project (Stenhouse, 1975) demonstrated that teachers could actively investigate and shape curricula, helping to establish the notion of teachers as researchers of their own professional practice.

1.2 Stenhouse and the formulation of the teacher-as-researcher concept

The term teacher as researcher was explicitly articulated by Lawrence Stenhouse (1975), who described curriculum as a "hypothesis" to be tested in classroom practice. Because teachers enact curriculum daily, Stenhouse argued they are best positioned to examine, adapt, and refine it. Teaching thus became an intellectual and investigative act, not merely a technical one.

Stenhouse's contribution was also moral and professional. By defining research as "systematic inquiry made public" (Stenhouse, 1981), he challenged the monopoly of academic researchers and legitimized teachers as producers of educational knowledge. In the context of debates about central control and professional autonomy, this framing provided teachers with a language of agency and collective responsibility that continues to influence European discussions of practitioner inquiry.

1.3 Action research, reflection, and professional agency

John Elliott (1991) extended Stenhouse's ideas by positioning action research as both a methodology for improving practice and a vehicle for democratic educational change. Emphasizing collaborative inquiry rooted in school contexts, Elliott rejected top-down reform in favour of change driven by teachers' own investigations. For him, action research was not merely technical but ethical, closely tied to questions of agency, collegiality, and professional responsibility (Elliott, 2007).

Around the same period, Donald Schön (1983) provided a powerful epistemological foundation through his concept of the reflective practitioner. Schön argued that professional knowledge emerges through reflection in and on action, challenging technical-rational models that cast teachers as passive implementers of external knowledge. His work reframed teachers as reflective practitioners who generate situated knowledge through engagement with practice, an idea that has become central in teacher education (Korthagen, 2001). Together, these perspectives connected inquiry, reflection, and professional identity.

1.4 The teacher research movement and epistemological debates

By the 1990s, teacher research had developed into an international movement, particularly in the United States. Cochran-Smith and Lytle (1993; 1999) provided a key epistemological framework by distinguishing between knowledge-for-practice, knowledge-in-practice, and knowledge-of-practice. This typology positioned teacher research as a legitimate form of professional knowledge and later reframed inquiry as a stance – an enduring orientation toward teaching, learning, and equity (Cochran-Smith & Lytle, 2009).

Other scholars, notably Kenneth Zeichner (1993; 2003), emphasized the role of inquiry in preservice teacher education, arguing that research engagement cultivates reflective habits that sustain professional learning across careers. Across this literature, inquiry was increasingly understood as collaborative rather than individual, embedded in professional communities.

Parallel to these developments, critical pedagogy traditions situated teacher research within emancipatory and political frameworks. Carr and Kemmis (1986) framed action research as a form of praxis aimed at challenging domination, while Grundy (1987), Giroux (1988), and Kincheloe (2003) emphasized empowerment, social justice, and teachers' roles as transformative intellectuals. This strand broadened the meaning of teacher research beyond improvement of practice to include equity and democratic change.

1.5 Global adaptations and persistent tensions

From the early 2000s, teacher research spread across diverse national contexts, adapting to different institutional and policy environments. Comparative work documented variations in how inquiry supported teacher autonomy in both highly regulated and more decentralized systems (e.g., Sachs, 2000). Despite this diversity, core ideas – reflection, inquiry, and professional agency – remained consistent.

At the same time, teacher research has faced sustained critique. Hargreaves (1996) questioned its rigor and policy relevance, prompting alternative conceptions of validity. Anderson and Herr (1999) proposed democratic, dialogic, and catalytic validity criteria aligned with participatory aims. These debates highlight enduring tensions between local and generalizable knowledge, professional learning and accountability, and democratic inquiry and evidence-based policy (Cain, 2015). Rather than being resolved, these tensions continue to shape how teacher research is understood and valued.

2. Student teachers as researchers in the context of teacher education

2.1 Historical and conceptual background

The idea that student teachers should engage in research during their preparation is rooted in the broader teacher-as-researcher tradition that emerged in the mid-twentieth century. Scholars challenged the view of teachers as passive transmitters of externally produced knowledge, arguing instead that teaching involves inquiry into practice. Stenhouse (1975) was central to this shift, framing teachers as curriculum developers who systematically investigate their own work. Teaching, in this view, involves questioning, testing, and refining pedagogical strategies, positioning teachers as producers rather than consumers of educational knowledge.

These ideas were extended by Elliott (1991), who presented action research as a flexible yet rigorous methodology for connecting educational ideals with classroom realities. Through iterative cycles of planning, acting, observing, and reflecting, teachers could shape practice in context and resist purely top-down reform. Practitioner research thus became not only a means of professional learning but also a democratic form of knowledge production.

Further conceptual clarification was offered by Zeichner and Noffke (2001), who distinguished personal, professional, and political dimensions of practitioner research, highlighting its reflective, developmental, and emancipatory functions. Later, Cochran-Smith and Lytle (2009) reframed inquiry as a stance – a durable orientation toward teaching, knowledge, and equity rather than a discrete task. This perspective has strongly influenced teacher education, emphasizing inquiry as central to professional identity. Practical approaches, such as those outlined by McNiff (2017), further demonstrated that inquiry is accessible even to novices when appropriately scaffolded.

Overall, positioning student teachers as researchers represents a shift from individual reflection toward structured, collaborative, and identity-shaping inquiry within teacher education.

2.2 Inquiry-based approaches in teacher education

Inquiry-based teacher education embeds research and systematic investigation into the core of preparation programs. Rather than emphasizing the application of theory alone, these approaches encourage student teachers to generate knowledge through engagement with practice. Common forms include action research, design-based research, and lesson study.

Research shows that inquiry during initial preparation supports long-term professional learning. For example, Smith and Sela (2005) found that student teachers who engaged in structured inquiry were more likely to sustain reflective practices later in their careers. To support novices, structured frameworks provide accessible guidance for conducting inquiry, reducing its perceived technical complexity.

Across contexts, inquiry-based approaches move teacher education away from apprenticeship models toward conceptions of student teachers as emerging professionals who actively investigate and shape their own practice. These approaches align closely with theories of teacher learning that emphasize agency, reflection, and identity formation.

2.3 International perspectives

Comparative research shows that inquiry-based teacher education takes diverse forms across national contexts. In the UK, practitioner research has been valued for its professional and ethical contributions alongside academic criteria (Furlong & Oancea, 2005). In Finland, research is treated as a core principle of teacher professionalism, with thesis requirements fostering methodological competence and evidence-informed judgment (Toom et al., 2010), though challenges related to workload persist (Niemi & Jakku-Sihvonen, 2006).

The Dutch concept of onderzoekende houding emphasizes an inquiring stance that supports reflection and agency, while also revealing tensions when inquiry becomes overly formalized (Verhoef & Volman, 2021). Similar patterns appear elsewhere: inquiry supports professionalization, but its impact depends heavily on institutional support and school–university partnerships. Overall, while inquiry-based teacher education is a global trend, it remains shaped by national traditions, policies, and professional cultures.

2.4 Benefits, limitations, and future directions

A substantial body of research highlights the benefits of engaging student teachers in inquiry. Inquiry supports the development of situated, practice-based knowledge (Cochran-Smith & Lytle, 1999), strengthens professional agency, and contributes to identity formation by positioning student teachers as emerging professionals. Longitudinal studies suggest that early research engagement can foster adaptive identities and resilience over time (Flores & Day, 2006).

At the same time, important limitations have been identified. Scholars caution against unrealistic expectations for novices and the risk of inquiry becoming a superficial, compliance-driven requirement (Furlong, 2013). Challenges include limited methodological expertise, time constraints, ethical complexities, and insufficient mentoring (Wilson, 2009; Friesen & Scott, 2013). Without adequate support, inquiry may become an additional burden rather than an empowering experience.

Looking ahead, research highlights the need for supportive structures that integrate inquiry with coursework and practice, including hybrid school–university spaces (Zeichner, 2010) and the thoughtful use of digital tools and data analytics (Toom & Husu, 2018). Policy-oriented analyses suggest that inquiry-oriented teacher education can support both quality and equity when aligned with broader competence frameworks (Darling-Hammond, 2017; Halász & Michel, 2011). Together, these trends indicate that while the concept of student teachers as researchers continues to evolve, its transformative potential depends on careful design, mentoring, and institutional commitment.

3. Teacher professional identity and competence development

3.1 Conceptual foundations

Over the past three decades, teacher professional identity has become a central focus of educational research, reflecting a shift from viewing teaching as the application of predefined methods to understanding it as a personal, social, and contextual practice (Kelchtermans, 2009; Beauchamp & Thomas, 2009). Earlier work in teacher education emphasized competences – knowledge, skills, and attitudes – as measurable outcomes, while later scholarship distinguished identity as the *who* of teaching and competences as the *what* and *how* (Beijaard, 2019). Both dimensions are essential for understanding teacher professional development.

Professional identity is commonly defined as teachers' evolving self-concept in relation to their professional roles. Beijaard, Meijer, and Verloop (2004) identified subject, pedagogical, and didactical expertise as key dimensions, all of which are continuously negotiated through experience and social interaction. Akkerman and Meijer (2011) further conceptualized identity as dialogical and multi-voiced, shaped by tensions between continuity and change, agency and constraint. Research consistently highlights the relational and contextual nature of identity, showing how it is influenced by institutional expectations, policy environments, and professional cultures (Day et al., 2006; Sachs, 2001).

Competences, by contrast, are often formalized within professional frameworks guiding teacher preparation and development. European and international policy documents emphasize transversal competences such as collaboration, adaptability, innovation, and digital literacy (European Commission, 2013; OECD, 2019; Redecker, 2020). Yet competences cannot be separated from identity. Studies show that teachers' ability to enact competences depends strongly on their sense of belonging, confidence, and identity stability (Flores & Day, 2006; Kelchtermans, 2009). Identity and competence thus interact cyclically: identity shapes how competences are understood and enacted, while competence development reshapes professional self-conception. This insight underscores the need for teacher education to support identity formation alongside competence acquisition (Pesti, 2019; Chrappán et al., 2021).

Increasingly, this interplay is framed within lifelong learning and teacher agency. Professional identity is not fixed at the end of initial preparation but evolves across career stages through continuous professional development (European Commission, 2017). From this perspective, teachers are active agents of their own learning (Biesta et al., 2015), and participation in research plays a key role by strengthening inquiry skills, reflective capacity, and professional agency.

3.2 Research, reflection, and identity formation

Research engagement is widely recognized as a powerful driver of professional identity formation. Inquiry positions teachers as knowledge producers rather than passive implementers of externally designed reforms (Cochran-Smith & Lytle, 2009; Zeichner, 2003). This insight builds on Schön's (1983) concept of the reflective practitioner, which emphasizes learning through reflection in and on action. Systematic inquiry deepens reflection by making tacit knowledge explicit and evidence-informed (Korthagen, 2017).

Empirical studies show that student teachers who engage in research develop more coherent and confident professional identities (Smith & Sela, 2005; Edwards & Mutton, 2007). Research

projects enable them to address authentic classroom problems and help bridge the persistent theory–practice gap (Munthe & Rogne, 2015). Inquiry also provides structured ways to negotiate identity tensions – such as innovation versus tradition or personal beliefs versus institutional demands – by creating safe spaces for experimentation within professional constraints (Beauchamp & Thomas, 2009).

Engagement in research further shapes professional stance. Sachs (2001) contrasted managerial professionalism, focused on compliance, with democratic professionalism grounded in collaboration and inquiry. Research participation tends to support the latter by fostering agency and critical engagement. International evidence illustrates variation across systems: in Finland, research-based teacher education supports inquiry-oriented identities, while in more accountability-driven contexts the role of practitioner research remains contested (Cochran-Smith & Zeichner, 2005).

The social dimension of inquiry is equally important. Drawing on Wenger's (1998) concept of communities of practice, research shows that collaborative inquiry strengthens both professional belonging and competence (Vangrieken et al., 2017). Digital environments further expand these possibilities by enabling online collaboration, data-informed reflection, and participation in wider professional networks, shaping identities attuned to digital and ethical dimensions of teaching (Szűts, 2020; Buda & Pesti, 2024). Overall, research acts as both mirror and catalyst, making existing beliefs visible while driving professional transformation.

3.3 Competence development through research engagement

Research engagement provides a powerful context for integrated competence development. Rather than treating competences as fixed attributes, recent scholarship conceptualizes them as dynamic combinations of knowledge, skills, and dispositions that evolve across contexts (European Commission, 2013; Darling-Hammond, 2017). Inquiry places student teachers in authentic and uncertain situations that require problem-solving, reflection, and adaptation.

Through action research cycles, student teachers strengthen pedagogical competences related to curriculum design, assessment, and classroom management while developing reflective habits that support sustainable practice (Kemmis et al., 2014). Research engagement also builds methodological competences, including question design, data analysis, and evidence-informed decision-making, which are increasingly seen as core aspects of teacher professionalism (Menter et al., 2010).

Digital competences form another important strand. Research activities often involve digital tools for data collection, collaboration, and dissemination, aligning naturally with the DigCompEdu framework (Redecker, 2020). Studies show that digital action research can support more sophisticated and pedagogically meaningful uses of technology (Buda & Pesti, 2024). Inquiry further strengthens collaborative and attitudinal competences, such as openness, resilience, and curiosity, which are essential for lifelong professional learning (Korthagen, 2017). Taken together, the literature supports the view that research is not an add-on but a catalyst for holistic competence development.

3.4 Communities, challenges, and future directions

Identity and competence development are deeply embedded in professional communities. Mentoring and professional learning communities play a critical role in shaping inquiry-oriented identities, particularly when they support collaboration and reflection rather than

compliance (Aspfors & Fransson, 2015). Research from Hungary and other contexts shows that practicum experiences integrating inquiry can significantly strengthen student teachers' professional confidence and sense of identity (Pesti, 2019; Chrappán et al., 2021). Digital communities further extend these processes by connecting teachers across institutional and national boundaries (Trust et al., 2016).

Despite these benefits, significant challenges remain. Structural constraints such as limited time, overloaded curricula, and weak mentoring can reduce inquiry to a bureaucratic requirement (Furlong & Oancea, 2005). Cultural tensions arise where professionalism is framed narrowly in managerial terms (Sachs, 2001), and identity tensions often intensify during the transition into early career teaching (Veenman, 1984).

Looking ahead, emerging trends – including artificial intelligence, increased global mobility, and growing emphasis on sustainability and social justice – are reshaping expectations of teacher professionalism. These developments reinforce the importance of inquiry-oriented teacher education that integrates competence development, identity formation, and ethical reflection (Cochran-Smith et al., 2018). Research engagement thus remains a powerful strategy for preparing teachers for the complexities of 21st-century practice, provided it is supported by coherent structures, professional cultures, and aligned policy frameworks.

4. The digital context as an emerging dimension

The growing prominence of digital technologies has reshaped the contexts in which teaching, learning, and teacher education take place. Rather than functioning merely as new delivery channels, digital environments transform relationships between teachers, learners, and knowledge, influencing how professional learning and inquiry are enacted (European Commission, 2017; Redecker, 2017). For teacher education, this digital turn is particularly significant because it intersects directly with research-based learning and professional identity formation.

Student teachers are now expected to develop not only subject and pedagogical competences, but also digital competences that enable them to design, evaluate, and critically reflect on technology-enhanced practices (Tondeur et al., 2017; Redecker & Punie, 2017). When combined with research-based learning, digital environments function both as objects of inquiry and as methodological resources. Digital tools support data collection, collaboration, and reflection, enabling inquiry to be embedded more directly in practice and extending the possibilities of inquiry-oriented teacher education (Cochrane & Narayan, 2017).

Digital platforms also blur traditional boundaries between research and teaching. Learning management systems, collaborative environments, and online networks allow student teachers to investigate their practice while teaching, often in real time, fostering iterative cycles of action and reflection (Zeichner, 2010). In this sense, digital pedagogy supports inquiry as a situated, multimodal, and collaborative process rather than a purely text-based or academic exercise. These practices strengthen connections between theory and practice while reinforcing digital literacy as a core professional competence (Instefjord & Munthe, 2017).

From a competence perspective, research engagement in digital contexts supports integrated professional development. Digital inquiry aligns with frameworks such as TPACK (Mishra & Koehler, 2006) by requiring student teachers to coordinate technological, pedagogical, and content knowledge. It also cultivates transversal competences, including collaboration,

adaptability, and critical thinking, while foregrounding ethical considerations such as data use, equity, and learner diversity (Cochrane & Narayan, 2017). Thus, digital environments do not merely support inquiry; they actively shape the competences and professional dispositions of future teachers.

The digital context also has important implications for professional identity. As teaching increasingly involves designing and curating digital learning environments, teachers assume expanded roles as facilitators, collaborators, and mediators of networked knowledge (Lantz-Andersson et al., 2018). These shifts can be empowering, enabling innovation and personalization, but they also generate tensions as teachers negotiate between traditional roles and emerging expectations (Kelchtermans, 2009). Developing a professional identity in digital contexts therefore requires integrating continuity with change rather than replacing established roles outright (Koehler & Mishra, 2009).

At the same time, digitalization introduces new ethical and social challenges. Issues of data privacy, algorithmic decision-making, and the digital divide raise questions about equity, consent, and professional responsibility (Selwyn, 2020). Emerging technologies such as artificial intelligence intensify these concerns, positioning teachers as critical mediators who must balance automated systems with human judgment and ethical awareness (Williamson & Eynon, 2020; Redecker et al., 2022).

Taken together, the digital context constitutes a powerful but ambivalent dimension of teacher professionalization. It amplifies the potential of research-based teacher education by embedding inquiry in practice, expanding collaborative spaces, and supporting competence development. At the same time, it reshapes professional identity and raises new ethical demands. For inquiry-oriented teacher education to fulfill its transformative promise, digital tools must be integrated critically and reflectively, aligned with professional values, and supported by institutional structures that promote equity, agency, and lifelong learning.

5. Conceptual model

5.1 Rationale and overview

Synthesizing the literature reviewed in this paper points to a shared developmental logic: student teacher research supports competence development and professional identity formation, which together contribute to professionalization. This process can be represented analytically as a linear pathway, but it is more accurately understood as cyclical and recursive. Research on reflection, identity, and lifelong learning shows that teacher development unfolds through repeated cycles of inquiry rather than one-way progression (Schön, 1983; Korthagen, 2017).

For this reason, the conceptual framework is presented in two complementary forms:

- A linear model, highlighting the directional relationship between research, competence/identity, and professionalization.
- A spiral model, capturing the iterative, identity-driven, and lifelong nature of professional growth.

Together, these models offer a coherent yet dynamic account of how research engagement shapes teacher professionalization.

5.2 The linear model: research as a developmental pathway

The linear model depicts a directional sequence in which student research acts as the entry point. Research engagement may take multiple forms (e.g. action research, design-based projects, theses) and varies in authenticity, duration, and degree of digital mediation. Across forms, research functions not only as knowledge production but as a learning strategy that develops cognitive, reflective, and epistemic capacities.

Through research participation, student teachers develop key competences, including inquiry skills, reflective competence, digital-pedagogical competence, and collaborative epistemic practices. At the same time, research contributes to professional identity formation, as student teachers increasingly see themselves as research-capable professionals able to generate and use evidence in practice.

Competence and identity together support professionalization outcomes, such as engagement in continuous professional development, adaptive and innovative practice, reflective habits of mind, professional agency, and resilience. In this model, research initiates a developmental chain culminating in professionalization (Figure 1).



Figure 1. Linear model

5.3 The spiral model: inquiry, identity, and lifelong development

While analytically useful, the linear model underrepresents the recursive nature of professional growth. The spiral model addresses this limitation by conceptualizing research as a stance rather than a discrete task (Cochran-Smith & Lytle, 2009). Teacher development unfolds through repeated cycles of inquiry, reflection, and reconstruction, marked by growth, reorientation, and renewed questioning.

Each cycle of the spiral comprises four interconnected moments:

1. Inquiry into practice, grounded in authentic professional problems.
2. Competence development, including methodological, reflective, pedagogical, and digital competences.

3. Identity consolidation, reinforcing a self-concept as an inquiry-oriented professional.
4. Professionalization, expressed through improved practice, innovation, and sometimes leadership.

Each cycle generates new questions, prompting further inquiry. Over time, the spiral expands outward, representing cumulative competence development and the deepening of professional identity (Figure 2).

At the core of the spiral lies identity, which functions both as an outcome and as a driving force. Strengthened identity motivates continued inquiry, while inquiry further refines competences and stabilizes identity. Professionalization is thus not an endpoint but an ongoing expansion of the professional self, aligned with principles of lifelong learning (OECD, 2019).

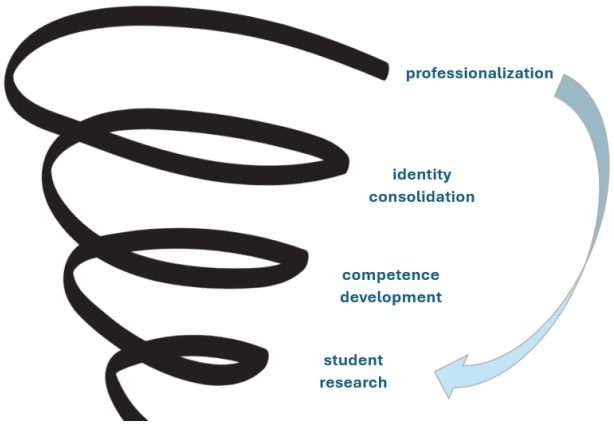


Figure 2. Spiral model

5.4 Mediators, moderators, and contextual dynamics

Both models assume that the relationship between research and professionalization is conditional rather than automatic. Mediating processes explain how research produces effects, while moderating factors shape whether and to what extent these effects occur.

Key mediators include:

- competence development (inquiry, reflective, and digital),
- professional identity formation (teacher-as-researcher stance),
- self-efficacy and professional agency.

Without these processes, research risks remaining superficial and disconnected from practice. Key moderators include program coherence, mentoring quality, learner characteristics, digital infrastructure, and school culture. These contextual factors help explain variation in outcomes and clarify why similar research tasks can produce very different professional trajectories across contexts.

5.5 Feedback, sustainability, and empirical gaps

Feedback mechanisms are essential for understanding sustainability. In the linear model, feedback appears as a return from professionalization to renewed research engagement. In the spiral model, feedback is structurally embedded: each cycle generates conditions for the next. Across both models, identity is the primary engine of sustainability, transforming research from an academic requirement into a lifelong professional orientation.

Despite their conceptual coherence, both models expose significant gaps in the empirical literature. Longitudinal evidence tracing research–identity–professionalization pathways remain scarce, and identity is often under-theorized and weakly operationalized. Research engagement is frequently treated as a uniform variable, obscuring differences in authenticity, duration, and ownership. Digital mediation and moderating factors such as mentoring and school culture are also rarely examined systematically.

Moreover, empirical work is geographically uneven, with limited evidence from Central and Eastern Europe. Finally, professionalization is often measured narrowly, despite both models pointing toward broader outcomes such as innovation, leadership, resilience, and sustained engagement in professional learning. Addressing these gaps provides a strong justification for the empirical study that follows.

Conclusion

The dual-model framework developed in this study offers a coherent conceptual account of how student research contributes to teacher professionalization. The linear model provides analytical clarity by tracing a pathway from research to competence and identity development, and onward to professionalization. The spiral model adds depth by capturing the recursive, identity-driven, and lifelong nature of professional growth. Together, the models balance precision and realism: the linear model avoids vagueness, while the spiral model avoids oversimplification.

The framework contributes theoretically by placing professional identity at the centre of professionalization, foregrounding digital mediation as an integral dimension of inquiry, recognizing contextual moderators such as mentoring and school culture, and introducing a temporal, cyclical perspective on teacher development. For empirical research, it supports longitudinal, mixed-methods, and comparative designs that move beyond short-term competence outcomes to include identity, context, and long-term trajectories.

The framework also has clear implications for practice and policy. Teacher education should position authentic, mentored, and digitally mediated research as a core element of preparation; mentors should be prepared to support inquiry as identity work; and policy frameworks should recognize research-informed teaching as a hallmark of professionalism. More broadly, institutions should cultivate inquiry-rich environments in which research is collaborative and sustained beyond initial teacher education.

Overall, the framework positions student research not as an optional enrichment activity but as a central mechanism of teacher professionalization, ensuring that competences are internalized, identity is continually renewed, and professional growth is understood as an ongoing process of becoming.

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Résumé: Teacher education increasingly emphasizes inquiry, reflection, and evidence-informed practice, yet the mechanisms through which student research contributes to long-term professional development remain under-theorized. While existing studies document the benefits of practitioner inquiry, they often focus on short-term competence gains, treat research as a uniform activity, or overlook the role of professional identity and digital mediation. This study

addresses these limitations by integrating literature on teacher research, identity formation, competence development, and digital pedagogy into a coherent conceptual framework. By proposing complementary linear and spiral models, it offers both analytical clarity and a dynamic account of professional growth as a recursive, lifelong process. The framework responds to calls for stronger theoretical grounding in inquiry-oriented teacher education and provides a basis for longitudinal, mixed-methods, and context-sensitive empirical research, including in underrepresented regions such as Central and Eastern Europe.

Résumé (Slovakian): Táto kapitola skúma zapojenie študentov učiteľstva do výskumu v počiatočnom vzdelávaní učiteľov (PVOU) a jeho prínos k rozvoju kompetencií a formovaniu profesijnej identity. Vychádza zo systematického prehľadu 131 empirických štúdií publikovaných v rokoch 2016-2025 a syntetizuje poznatky o formách, kontextoch, výsledkoch a podmienkach výskumného zapojenia. Zistenia ukazujú, že bádateľská činnosť v PVOU je najčastejšie realizovaná prostredníctvom kolaboratívnych a riadených projektov v rámci kurzov a pedagogickej praxe, zatiaľ čo rozsiahle samostatné výskumy sú menej časté. Zapojenie do výskumu je úzko spojené s rozvojom na prax orientovaných kompetencií, ako sú pedagogické zručnosti, práca s dôkazmi, spolupráca a riešenie problémov, a zároveň podporuje aspekty profesijnej identity, najmä autonómiu a profesionalitu. Koncepčne dominuje pole reflexívnymi a na prax orientovanými rámcami, zatiaľ čo metodologicky prevažujú kvalitatívne a prípadové štúdie. Celkovo kapitola poukazuje na výskumné zapojenie ako na formujúcu, no nerovnomerne rozvinutú súčasť prípravy učiteľov a zdôrazňuje potrebu širších kontextov, rozmanitejších metód a silnejšej integrácie bádania v PVOU.

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