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Teacher knowledge between theory and practice: An epistemological reflection

Abstract: Knowledge is a fundamental element of a teacher's professional identity and a key factor in the quality of education. This theoretical paper aims to explore the epistemological perspective of teacher knowledge and reflect on it from the perspective of professional development. It presents an integrative framework composed of six interconnected parts: empiricism (learning from experience and observation), rationalism (gaining knowledge through reasoning and theory), constructivism (building knowledge through interaction and context), pragmatism (using knowledge to solve problems), critical rationalism (seeing knowledge as a hypothesis tested in real life) and social epistemology (understanding knowledge as something shared and created socially). Thus, teacher knowledge is viewed as a dynamic synthesis of different epistemological traditions. Special attention is given to contemporary models of teacher knowledge – Shulman's pedagogical content knowledge and Mishra and Koehler's technological pedagogical content knowledge. These models are interpreted through a broader epistemological framework. It is concluded that teacher knowledge is not a static category but a multidimensional and adaptable construct. It emerges from the dialogue between theory and practice and develops through lifelong learning, reflection and professional collaboration. Such an understanding encourages innovative teacher professional development in the contemporary knowledge society.

Keywords: constructivism, epistemology, pedagogical content knowledge, teacher knowledge, technological pedagogical content knowledge

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Introduction

Knowledge in modern society is rapidly evolving and constantly reshaping. The idea of a knowledge society and the concept of lifelong learning have transformed the understanding of the teaching profession. Today, the teaching profession is considered a knowledge profession (Ulferts 2021) in which teachers remain learners. A modern teacher is expected to act as an empowered learner – that is, curious and inquisitive, reflective and analytical, intrinsically motivated and autonomous in professional judgment (Cannella and Reiff 1994).

Teacher knowledge forms a central part of professional identity and has a decisive influence on the quality of education. It affects how teachers interpret, design and adapt learning environments and how effectively they facilitate learning and student achievements. Over the years, educational researchers have examined teacher knowledge from psychological, sociological and pedagogical perspectives. However, there is still a need for a deeper epistemological discussion that places this knowledge within broader philosophical traditions. Therefore, this paper aims to consider the epistemological foundations of teacher knowledge and discuss their implications for contemporary professional learning.

Conceptual Definition of Teacher Knowledge

Although the competence paradigm currently dominates education, increasing attention has been focused on understanding teacher knowledge as an essential part of the competence profile. The concept itself has its roots in the Anglo-Saxon educational tradition, in which it was introduced by Esland and Keddie in the early 1970s through the sociology of education (Elbaz-Luwisch and Orland-Barak 2013). While research on teaching has a much longer history, systematic research on teacher knowledge began later, mainly during the 1980s and 1990s, and was initially conducted by scholars from British and American contexts. Over the years, researchers from Europe and Asia have taken and further developed this concept, bringing new theoretical perspectives.

Nowadays, teacher knowledge is viewed as a concept that grew out of interactions of the Anglo-Saxon and European traditions, each adding its own unique ideas and terms.

Different researchers have interpreted teacher knowledge in their own ways, focusing on the aspects they find most important. This has led to the broadening of its meaning, and its internal structure has become more clearly defined over time. According to Fenstermacher (1994), teacher knowledge can be used in three main ways: (1) to refer to formal and practical knowledge grounded in epistemology; (2) as a general label for teachers' mental states that come from training, experience and reflection, carrying little or no epistemological weight; and (3) as a socially valued idea that helps legitimise teachers' insights and beliefs.

Grossman and Richert (1988) define teacher knowledge as a set of professional knowledge that includes subject-specific knowledge and general pedagogical knowledge, such as learning theories, teaching principles, educational philosophies, knowledge about students and classroom management. Carter (1990) views it as the sum of what a teacher knows at a given moment, which forms the basis for their professional practice. Calderhead (1996) describes teacher knowledge as a complex concept that includes formal theoretical understanding and practical knowledge that teachers acquire through everyday experience. This perspective is closely related to Eraut's (1994) distinction between explicit, formal knowledge and practical, experiential understanding, which often remains implicit or tacit. It can also be related to Tamir's (1991) idea that theoretical knowledge becomes practical through experience and to Ryle's (1949) distinction between *knowing that* and *knowing how*.

Dutch researchers Meijer et al. (1999) and Verloop et al. (2001) were among the first in Europe to accept and explore the idea of teacher knowledge and introduce it into the European educational context. They understand teacher knowledge as a comprehensive concept that includes theoretical and practical dimensions and implies the entire knowledge and insights that are the basis of teachers' actions in practice, including both what teachers consciously believe and what they intuitively understand, often without being fully aware of it (Verloop et al. 2001). Summarising earlier work, Meijer et al. (1999) highlight several key characteristics of teacher knowledge: personal, shaped by context, reflective, rooted in practice, largely tacit and closely related to the teaching subject.

Although the term *practical* is often mentioned in studies on teaching, curriculum and teacher knowledge, its originator was Schwab (1969), who belonged to the American educational tradition. He argued that theory cannot simply be translated into the classroom because teaching deals with real people and situations and that the teacher must actively reflect and make decisions in practice. Unlike the universal and ubiquitous subject matter that is dealt with theoretically, the subject matter of the practical is concrete and specific (Schwab and Harper 1970). The method of deliberation inherent in the practical is what essentially distinguishes it from the scientific method inherent in the theoretical. Therefore, the outcome of the practical is always a decision, and the outcome of the theoretical is knowledge (ibid.). Künzli (2013) saw the possibility of linking the German tradition of general didactics to Schwab's idea of the practical as humanistic di-

dactics is considered science from practice and for practice. However, the author claims that his work was largely ignored in the German context until similar practical curriculum issues emerged there, as in American education (ibid.). Elbaz (1981) was the first to introduce the concept of practical teacher knowledge to encompass the experiential dimension of teaching while taking into account Dewey's view of the dialectical connection between theory and practice and Polanyi's concept of personal knowledge. She was aware that the generalisability of practical teacher knowledge is a problematic area and that it cannot be viewed within the logic and propositional structure of theoretical knowledge. Therefore, it is much more useful to view it through a process of deliberation that results in a decision.

Teachers' practical knowledge can be focused on different aspects, for example, subject knowledge, student knowledge and knowledge about student learning and understanding (Meijer et al. 1999). A form of teaching activity in the sense of a subtle skill based on intuition is also known in the European tradition as a pedagogical tact, which was introduced as an original pedagogical concept by Herbart in the 19th century and further elaborated in contemporary pedagogy (Van Manen 2016). Specifically, Herbart emphasised that the learner cannot be understood exclusively through theory or experience but precisely in the space between them with the help of the educator's pedagogical tact, which is considered the pinnacle of pedagogical skill (Palekčić 2010; Van Manen 2016).

In sum, teacher knowledge is not only a set of theories and practical advice but also a dynamic, continuously developing concept that grows through professional practice. In this process, the roles of reflection, experience and adaptation are very important. Drawing on Ryle's (1949) ideas of *knowing that* and *knowing* how, Schwab's (1969) distinction between theory and practice, and the way teacher knowledge is understood today, this paper uses the term teacher knowledge to refer to the *full range of theoretical and practical knowledge that supports a teacher's professional work*.

Epistemological Approach to Teacher Knowledge

The epistemological paradigm in the processes of learning and teaching achieves a strong correlation with the normative science of education as one of the fundamental theoretical approaches in pedagogical science. Defining clear principles and values as key theoretical norms, continuity is the main focus of pedagogical practice. Since the time of Plato, traditional epistemology has primarily focused on the content of propositional knowledge. Indeed, when we speak about modern epistemology, the meaning of knowledge is understood in a broader sense, including not only factual knowledge but also knowledge about how to do something and how to construct the knowledge.

This perspective in the content by the British philosopher Ryle (1949) clearly distinguishes the meaning between the two concepts of *knowledge that* and *knowledge how*, in which *knowledge that* means propositional knowledge, while *knowledge how* means procedural knowledge. Continuing his thought, Ryle paid

attention to the gap between the possession of factual knowledge and the knowledge of how to apply it. In this context, he emphasises the difference between understanding the main theoretical principles on one side and their qualitative application in education practice on the other side. Historically, this moment defined a change in the theory of epistemology from a static and passive view of knowledge to an adaptive and active view oriented towards everyday practice. In terms of exploring the epistemological dimensions of teacher knowledge, it is important to emphasise and consider the frame in which knowledge is acquired. In the context and content of initial teacher education, the theoretical understanding of any conceptual framework is the first step to introducing reflection in a rational approach. This meaning of knowledge is presented through empirical experiences in each classroom in which prospective teachers first adapt and then redefine what they have learned.

In understanding and elaborating this interaction between theory and practice in the context of everyday school, we provide a frame for defining other dimensions of teacher knowledge, including other theoretical backgrounds, such as constructivism, pragmatism, critical-rationalism and social-epistemological perspectives. By defining the role of the epistemological approach in scientific discourse, we consider basic quality educational practice with a clear orientation to the basic theoretical framework as a key assumption of successful everyday teacher practice. We focus on the idea that epistemological science begins first from efficient practice. Afterwards, the meaning is geared towards the aim and scope that the correlation with the normative theoretical conception is a starting paradigm.

Rationalism

Rationalism, in the context of teacher knowledge, is reflected in the theoretical dimensions of both subject knowledge and pedagogical knowledge. Substantive knowledge includes an understanding of the fundamental concepts, principles and relationships, while syntactic knowledge includes an understanding of the structure, the methods of organisation and the criteria for evaluating and validating new knowledge content (Schwab 1969; Vican 2007). Furthermore, we explain that theoretical knowledge about teaching encompasses the pedagogical principles, didactic models and instructional frameworks that guide classroom planning and decision-making. In the relationship with rationalism, as a basically philosophical tradition, rationalism emphasises the role of reason and logical deduction as primary sources of every knowledge content. Descartes famously asserted *cogito, ergo sum* (*I think, therefore I am*), arguing that certain truths can be determined only through reason (Descartes 1641/1996). For example, Leibniz argues that human knowledge starts with ideas and logical principles, insisting that nothing enters the mind that has not first passed through the senses, except the mind's own capacity for understanding (Leibniz 1765/1996). The philosopher Kant later detected and reconciled rationalism and empiricism, arguing that thought needs the content of experience to have a meaning first, while later experience needs thought to gain insight (Kant 1781/1998). In the

pedagogical tradition, Herbart emphasises that teaching must be based on a systematic theory, defining that education has both scientific and moral dimensions aimed at character formation (Palekčić 2010).

Although empirical research was used in the classroom context, it served more as a corrective when findings conflicted with established models than as a basis for their construction (Pepin 1999). Oriented towards the tradition of upbringing, German didactics reflected Humboldt's vision of education as emancipation, self-determination and the development of autonomous and critical individuals, in which education was valued as an end in itself and not only for its practical aim (Topolovčan and Matijević 2017). In the literature, this body of knowledge is referred to as *knowledge for practice*, a concept developed within the theoretical framework of teacher knowledge proposed by Cochran-Smith and Lytle (1999). This tradition strongly presents rationalist thought, giving priority to theoretical thinking and universal principles over experiential knowledge, and has a lasting impact on teaching practices and teacher education in continental Europe (Matanović 2017). It defines and presents teachers' formal knowledge and general theories about subject content, educational theory, human development, students, classroom organisation, teaching, assessment, the broader socio-cultural context of schooling and the teaching profession itself. This knowledge about teaching and learning is explained and disseminated through books and study programmes in initial teacher education and professional development. It is also applied to improve classroom practice. Within this concept, knowledge is seen as existing outside of teachers, created by researchers through qualitative and quantitative studies, with teachers primarily positioned as users rather than creators of knowledge.

Knowledge for practice emphasises the starting point of formal theories and research-based thoughts of teachers. This perspective also highlights its limitations in capturing the realities of life in the classroom. It presents the way for epistemological traditions, such as empiricism, and places experience and observation at the centre of knowledge formation. In the context of teacher knowledge, empiricism provides a balance to theory-based approaches, emphasising the value of learning derived directly from practice and interactions between teachers and students. By grounding their practice in theoretical understanding, teachers can systematically interpret, adapt, and apply knowledge, ensuring that their instructional decisions are based on established principles.

Empiricism

In the context of teacher knowledge, empiricism is reflected in the practical dimensions of professional expertise of each participant in the educational process. Teachers develop tacit and experiential knowledge through classroom interactions, observation of student behaviour and reflection on practice. This knowledge is closely connected to didactic models that emphasise active learning, experiential learning theory and frameworks for reflective practice. Empiricism, as a philosophical tradition, emphasises sensory experience and observation as the foundation of knowledge. For example, Locke (1690/1996) describes the hu-

man mind at birth as a *tabula rasa*, shaped entirely by experience. Conversely, Bacon (1620/2000) considers the inductive method to be the most reliable starting point for knowledge. Hume (1748/1999) further argues that all ideas arise from impressions by grounding knowledge in the immediacy of experience while remaining sceptical about the possibility of certain knowledge of causal relationships, which he claims is based on habit rather than logical necessity. These philosophical insights have strongly shaped the educational theory of empiricism.

Pedagogue Pestalozzi (1801/1894) emphasises that children should learn first by engaging their senses and observing their environment and considers sensory experience forms the basis of all knowledge. Similarly, Dewey (1933) asserts that knowledge arises through reflection on concrete experience and active problem solving, placing experiential learning at the centre of modern pedagogy. Thus, teachers' empirically based knowledge complements theoretical frames, enabling educators to respond flexibly to classroom realities and redefine their practice through experience. Translating theory, or publicly codified knowledge, into forms useful to classroom practice is an important dimension of teacher knowledge, characterised by its close connection with teachers' experiences of experimenting with practice (Loughran 2012). By using reflection and professional experience, teachers abstract general principles from theory and meaningfully adapt them to specific teaching contexts. This process enables them to transform theoretical insights into practical strategies and methods that can be effectively applied in the classroom.

Schön's (1983) concept of *knowledge in action* can initially be understood within the empiricist tradition, as it emphasises the experience, observation and practical dimension of professional work. Knowledge is not seen as a separate theory but as something connected with the actions and decisions that teachers make in real classroom situations through reflection on practice. Moreover, Schön's idea of a *new epistemology of practice* goes beyond empiricism and closely aligns with constructivism. By emphasising the way in which teachers actively interpret, reconstruct and generate knowledge in interactions with specific contexts, Schön positions teachers' knowledge as a dynamic, situational and co-constructed process with the issues of understanding, which provides a natural transition to constructivist perspectives.

Constructivism

In the context of the humanistic developmental paradigm, constructivism and social constructivism form the basis of effective educational practice in the process of learning and teaching. From this point of view, the student is positioned as the subject of the teaching process. Constructivism, as a philosophical and epistemological perspective, emphasises that knowledge is actively constructed by the student first but not passively received from the environment. As mentioned in the works of philosophers and psychologists who explored the nature of human understanding, it has been widely applied in educational theory and practice at each level of the educational system. In the context of education, constructivism highlights the active role of students in understanding their

experiences and personal engagement with new information. Contributions to educational constructivism include more theory content. For example, Piaget (1926, 1970) investigated children's cognitive development and the processes by which they construct knowledge, Vygotsky (1962, 1978) emphasised the social and cultural mediation of learning, and Bruner (2000) focused on the role of culture and guided discovery in education. Altogether, these theoretical frameworks established the foundation for understanding learning as an active, contextually embedded, and socially mediated process.

Educational reforms and research in the late 20th and early 21st centuries have established constructivism as the dominant paradigm (Abdal-Haqq 1998; Beck and Kosnik 2012). Contemporary teacher education emphasises enquiry-based learning, collaboration, reflective professional judgment and adaptation to constant change by enabling teachers to analyse contextual factors, set priorities and make informed instructional decisions (Barak 2017; Richert 2002). This change has shifted the conceptualisation of teacher knowledge and professional development towards constructivist and socio-constructivist frameworks. Instead of viewing knowledge as an individual possession acquired through transmission, these perspectives understand it as shaped through interaction, collaboration and the specific context in which teachers work.

Richardson (2005) identifies and presents two forms of constructivist teacher education: 1) teaching students how to teach in a constructivist way within specific subject areas and 2) engaging students in constructivist learning to explore and revise their tacit understandings. While the first approach often relies on direct instruction and limits opportunities for active enquiry, the second approach underscores modelling in which students actively explore premises and perspectives more in line with the constructivist practices expected of future teachers (ibid). The concept of *knowledge in practice*, as articulated by Cochran-Smith and Lytle (1999), is based on a constructivist perspective, which involves experiential learning, continuous reflection and exploration of the concept of teaching.

Building on the previous discussion of constructivist approaches to teacher education, Piagetian (developmental) constructivists view meaning making as an individual process aimed at fostering deeper understanding and analytical skills. Students actively reconstruct, adapt or transform their existing cognitive frameworks, while teachers create a stimulating environment with tasks and questions that provide reflection and cognitive dissonance. By contrast, drawing on Dewey (1916) and Vygotsky (1962), social constructivists emphasise meaning making as a socially mediated process in which everyone is included. In this sense, knowledge is co-constructed through interactions within a group and then internalised by individuals. In general teacher education, higher education and school contexts, students collaboratively construct knowledge through interactions with peers, instructors and mentors during professional practice. From a socio-constructivist perspective, formal knowledge serves as a tool for social interaction and meaning making.

Pragmatism

The philosophical tradition of pragmatism focuses on the practical value of theoretical principles. Peirce (1878) emphasises the importance of considering the practical effects of ideas, while James (1907) asserts that truth and meaning are verified through experience and utility. Dewey (1916, 1933) brought these ideas into education, suggesting that students learn best when they work on real-world problems and reflect on what they have done, making a connection between theory and everyday life. Recently, theorists such as Biesta (1994) have continued this tradition by showing how pragmatism fits teacher education by highlighting how knowledge, action and context interplay when teachers make professional decisions.

The presence of pragmatism in modern education is visible in the adoption of professional standards in the teaching profession, which aim to regulate and improve the quality of education. They help teachers reflect, experiment and adapt their practices, and they learn through this. In this way, they continuously build knowledge, testing and adapting strategies as they face real challenges in the classroom, which is consistent with Dewey's (1916) learning through experience and enquiry. Moreover, Schön's (1983) idea of professional *knowledge in action* and the *new epistemology of practice* is in accordance with this view of learning, as it sees it as a changing process in which knowledge is created, applied and evaluated in context.

Thus, pragmatically oriented standards aimed at regulating the quality of education help teachers improve their practice and grow professionally, connecting formal knowledge with real action in the classroom. Communities of practice (Wenger 1998) play an important role in this, as they provide space for teachers to reflect together, share tacit knowledge and collectively construct new knowledge.

Critical rationalism

Critical rationalism came as an answer to classical empiricism and logical positivism. Popper (1959) believes that progress happens when we test our ideas, observe their weakness and are open to replacing them with better ideas. Thus, from this perspective, knowledge is not something static or absolutely true, but it grows through conjectures and refutations as ideas are tested and revised in light of evidence. In the context of teacher knowledge, this means that critical reflection and questioning are important. Teachers develop professionally by revising their methods and changing practices based on new insights and evidence, not just by memorising new facts. They are not just transmitters of ready-made truths but also reflective practitioners.

In contrast to pragmatism, which focuses on how knowledge functions in solving real-world problems (Dewey 1916; James 1907), critical rationalism views knowledge as something that must always remain open to criticism and revision (Popper 1959). Thus, rather than seeing teachers' knowledge as something stable and complete, this view sees it as something provisional – always

in the process of being tested, challenged and improved. This idea fits well with current approaches to teacher education that emphasise enquiry, reflection and continuous questioning of practice (Cochran-Smith and Lytle 1999; Hagger and McIntyre 2006).

This way of thinking is directly connected with action research in education in which teachers systematically investigate their own practice: they form ideas about what should work, test these ideas in the classroom and then retain or revise them depending on the results. When outcomes do not meet expectations, the original assumptions are re-examined, which is precisely how Popper describes the growth of knowledge. Action research is essentially critical rationalism in action because it encourages experimentation, reflection and improvement in which teachers not only use but also create knowledge (Kemmis et al. 2014). In this way, teachers are active investigators, using their practice to help build and improve educational knowledge.

Social epistemology

In the context of social epistemology, knowledge construction points to the collective creation and continuous improvement of ideas that have values for the professional community as a whole, moving beyond individual learning activities towards the creation of public knowledge. The concept of teacher knowledge construction, based on the work of Bereiter and Scardamalia (2014), is aligned with the principles of social epistemology, which views knowledge as a socially distributed and collaboratively constructed process in which each participant has a clear position. Within this framework, teachers engage in sustained active dialogue based on the co-construction of meaning, thus contributing to the advancement of professional practice on the one hand and educational theory on the other hand. Social epistemology emphasises that knowledge is not only located in individual minds but is distributed across social networks, communities and institutions (Fuller 2002; Goldman 1999).

In organisational and educational contexts, this perspective is further developed through concepts such as communities of practice, in which learning and knowledge creation are presented through participation and social interaction (Wenger 1998). Similarly, Nonaka and Takeuchi (1995) underscore the dynamic conversion between tacit and explicit knowledge within groups, showing how knowledge develops through sharing experiences by presenting collective reflection (Figure 1). The authors then conceptualise organisational knowledge creation as a continuous spiral process that involves dynamic interactions between tacit and explicit knowledge at both the individual and collective levels. Their SECI model outlines four modes of knowledge conversion: socialisation (tacit to tacit), externalisation (tacit to explicit), combination (explicit to explicit) and internalisation (explicit to tacit).

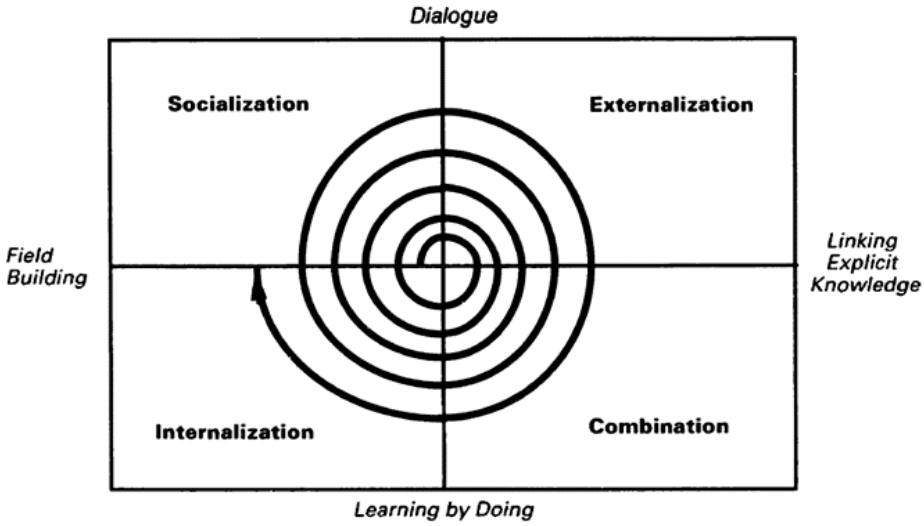

Figure 1: The spiral of knowledge (Nonaka and Takeuchi 1995, p. 71)

The implementation of social epistemology in teacher knowledge shows the role of professional communities, mentoring and collaborative enquiry in constructing, redefining and disseminating practical and theoretical understandings within the teaching profession. Teachers actively share their experiences in between, collectively reflect on classroom practices and, at the same time, negotiate each meaning (Fuller 2002; Nonaka and Takeuchi 1995; Wenger 1998). This perspective aligns with action research and reflective practice, as teachers systematically explore their own teaching, test interventions and disseminate insights through networks. By situating teacher knowledge within a socially distributed framework, it becomes apparent that professional development, instructional decision-making and innovation are key assumptions in the social structures and collaborative processes of the teaching profession. Knowledge in this content is not only acquired individually but dynamically defines the process from the interplay of theory to practice and community engagement.

The principle of social epistemology conceptualises teachers' *knowledge of practise* (Cochran-Smith and Lytle 1999) as socially constructed and distributed through collaboration in professional and research communities. From this perspective, knowledge is not situated individually but is co-created through interaction, dialogue and collaborative exploration of teaching, learning and schooling. This is in accordance with social epistemological accounts of knowledge as collective and situational (Fuller 2002; Goldman 1999; Nonaka and Takeuchi 1995; Wenger 1998), in which meaning is negotiated and affirmed through shared and together engagement. Within such collaborative research, implicit professional knowledge becomes explicit, open to critique and transformed into shared insights that contribute to the broader improvement of educational practice and policy. Teachers are seen as active participants and co-constructors

of knowledge, creating new understandings through critical reflection and action research rather than simply applying externally produced theories. In this content, we participate in a new organisational paradigm in which each school participant has a clear role in creating the curriculum process and defines the framework for connecting theory and practice.

Integrative epistemological framework of teacher knowledge

In accordance with the reflections presented in this chapter, Figure 2 presents an integrative framework of teacher knowledge, with six interconnected perspectives shaping the understanding of teacher expertise. At its centre is teacher knowledge, which is viewed through ideas of rationalism, empiricism, constructivism, pragmatism, critical rationalism and social epistemology. Rationalism focuses on logic and theory, helping teachers plan and make decisions, while empiricism focuses on learning from experience and observation. Constructivism states that learning occurs through interacting with others and the environment, both individually and socially. Pragmatism connects theory with actual classroom practice, viewing knowledge as a tool for solving problems. Critical rationalism understands knowledge as something that is tested and refined through research and reflection, while social epistemology indicates that knowledge is shared and co-constructed in professional communities.

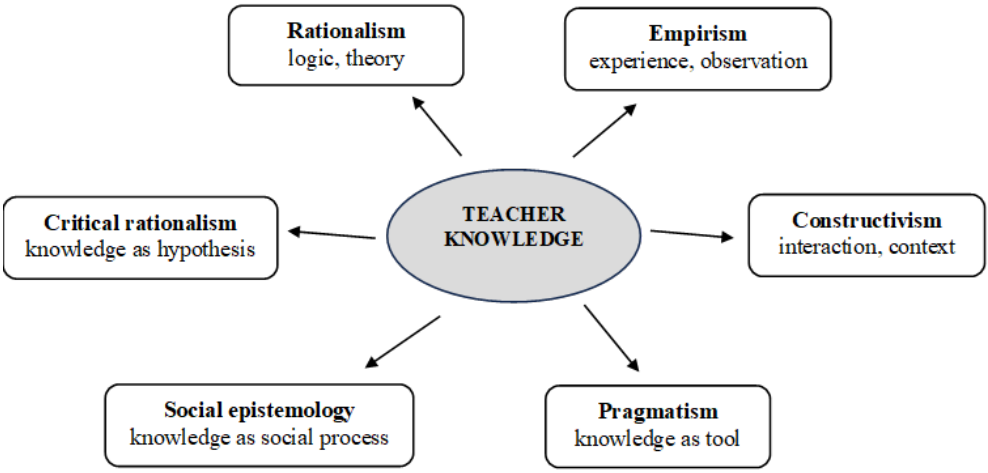

Figure 2: Integrative epistemological framework of teacher knowledge.

The different ways of thinking about teacher knowledge can be considered part of a larger system in which knowledge keeps moving, changing and being reused within the wider ecosystem of evidence and innovation (Révai 2020). Révai discusses *knowledge mobilisation* – that is, the way knowledge is shared, reshaped and used – to support innovation in education (ibid.).

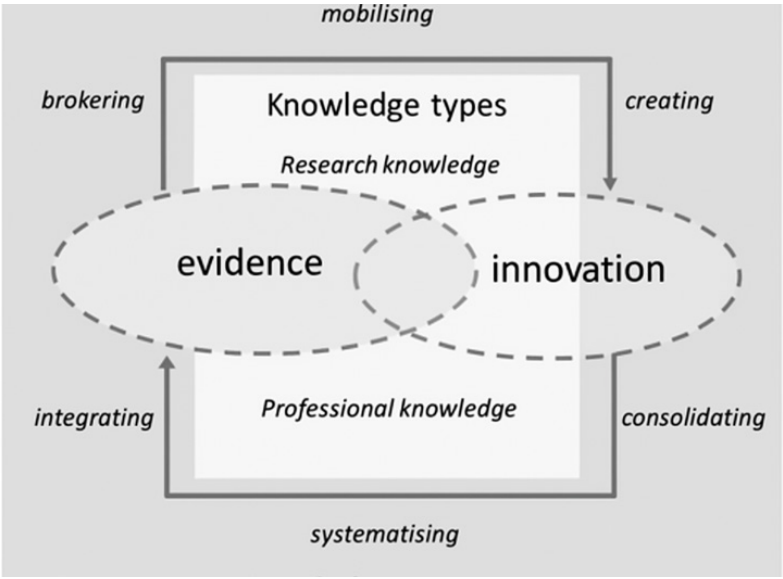

Figure 3: Knowledge dynamics in the evidence–innovation ecosystem (Révai 2020, p. 53)

This model shows how teachers' knowledge constantly shifts between research and everyday classroom practice. Teachers rely on their own experience, reflect with colleagues, question what they are doing and gradually build new insights together, thus bringing in elements of empiricism, constructivism and critical reflection. In this way, Révai's framework fits with the integrative model, especially with social epistemology, which sees knowledge as something created together, shaped by the context and always changing within a community of professionals. Furthermore, the contemporary paradigm of teacher knowledge dynamics focuses on effective mechanisms of formal research knowledge dissemination, with which teaching practice needs to be aligned. Therefore, knowledge mobilisation, which involves processes that increase the use of research evidence in teaching practice, is extremely important. It is evident that contemporary teachers not only learn but also generate knowledge through experiments, practice and reflection. They are knowledge users, researchers and innovators at the same time.

In establishing the connection between theory and practice in teaching, it is crucial to highlight teachers' pedagogical tact as the ability to act caringly and appropriately in the moment (Van Manen 2016). It is a key area for effective knowledge transfer that respects the unique needs and characteristics of each student. Pedagogical tact is acquired only through practice in which experience shapes sense but only if the individual has first received theoretical education, as tact not only rests on insight but also on feeling (Palekčić 2010). From an epistemological perspective, pedagogical tact implies a dynamic interaction of empiricism, rationalism and constructivism, as it relies on observation, reflection and social interaction in professional decision-making.

Contemporary models of teacher knowledge from an epistemological perspective

Contemporary models of teacher knowledge emphasise connecting content knowledge with an understanding of how to teach it, and they can be viewed through the prism of epistemological traditions. One of the most well-known frameworks is Shulman's (1986, 1987) pedagogical content knowledge (PCK), which describes the specific knowledge that enables subject content to be taught in a way that is understandable to students. This framework was later expanded by the technological pedagogical content knowledge (TPACK) model (Mishra and Koehler 2006), which adds a dimension of technology and shows how content, pedagogy and technology are intertwined in modern teaching.

PCK

Shulman (1986) introduced the concept of PCK, which refers to specific teacher knowledge in which professional content and teaching skills are combined – that is, how something that a teacher knows is transformed into something that students can understand. As the structure of knowledge differs from subject to subject, the author highlights that content knowledge is not just knowing facts but also understanding how these facts are connected, why they are valid and why they are important. Therefore, Shulman (1987) presented the concept of *pedagogical reasoning* – a process in which teachers understand content, adapt it, teach it, assess students' understanding and finally reflect on their own practice. In this way, learning and teaching are not reduced to routine but to reflection and continuous improvement. Therefore, PCK includes identifying key topics in a subject, choosing effective ways to explain them and adapting to different students through examples, visualisations or working methods. This concept connects what has long been traditionally kept separate – content knowledge and teaching knowledge (Mishra and Koehler 2006). Among other things, Shulman (1987) identified seven categories of teacher knowledge bases: content knowledge, general pedagogical knowledge, curricular knowledge, pedagogical content knowledge, knowledge about students and their characteristics, knowledge about educational contexts and knowledge about educational goals, purposes, values and their philosophical and historical foundations.

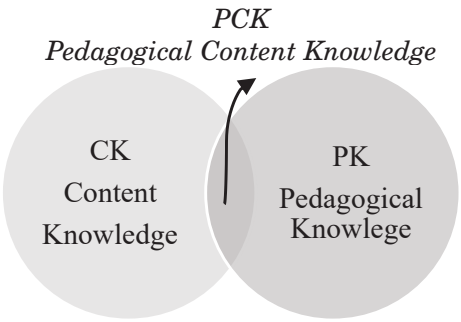

Figure 4: Presentation of Shulman's model of pedagogical content knowledge (Mishra and Koehler 2006, p. 1022)

Because students are different, there is no one perfect way to teach a topic. This is why Shulman underscores that teachers should have a variety of possible

approaches, whether they come from research or from their own classroom experience. According to Shulman (1987), teacher knowledge has four main sources: academic education, curriculum and institutional guidelines, research on teaching and learning and practical wisdom gained through classroom work. This means that teacher education is not only about acquiring ready-made recipes but also developing the ability to reflect, analyse and make informed decisions based on their own professional knowledge.

Despite the different approaches, interpretations, extensions and critiques of PCK, it is evident that it is based on practical experience and that it includes a connected system of knowledge, beliefs and values formed in the teaching context (Gess-Newsome 1999; Lee et al. 2007). This model has significantly stimulated research on teacher knowledge, particularly emphasising the importance of professional content and how it is translated into teaching. It has also influenced changes in curriculum planning (Gess-Newsome 1999), especially in the American context, in which teaching content has gained greater importance due to its connection with cognitivism and action research (Kansanen 1999).

Ges-Newsome (1999) conducted a study on the nature of PCK along a continuum, with one end representing an integrative perspective and the other end representing a transformative perspective. The integrative perspective views PCK as a combination of different types of knowledge (subject, pedagogical and contextual). Conversely, the transformative view implies that subject, pedagogical and contextual knowledge are transformed into a new form of knowledge (i.e. PCK) that cannot be understood simply by summing up its parts. Instead of the earlier dichotomy, contemporary approaches (Consensus and Refined Consensus Model) define PCK as a holistic, dynamic and contextually conditioned system of professional knowledge (Chaitidou and Peikos 2026). Today, PCK research is particularly interesting in the context of the application of artificial intelligence (AI). This emphasises that teachers must actively rely on their personal PCK to critically reflect on AI-generated content and activities. The teacher remains the key person responsible for assessing the fit of AI-generated results with specific learning contexts, ensuring their situational relevance and pedagogical integrity during classroom instruction (ibid.).

From the above, it is evident that PCK models vary in epistemological approach and structural component. PCK integrates both theory and experience into teacher knowledge; thus, in epistemological terms, we can say that it is a combination of rationalist and empiricist paradigms. It relies on the rationalist idea that teachers must have a good understanding of the structure of their subjects and on empiricism, which emphasises that real knowledge is developed through work in the classroom through observation, experience and adaptation to students. However, Shulman goes a step further: through the concept of pedagogical reasoning, he shows that teacher knowledge is not only about knowing and applying but also about constantly reflecting, reshaping and adapting what is known to concrete situations, which fits well with the constructivist view of knowledge. In PCK, there is also an alignment with critical rationalism because teachers constantly test and refine their ideas in practice. However, this connection is limited, as this model is more concerned with how to transform content into teaching than with critically examining theoretical assumptions.

TPACK

The TPACK model was created by Mishra and Koehler (2006) based on their research into how teachers develop professionally and how new teachers are trained. This model connects what teachers know, how they teach in real classrooms and the role technology plays in learning today. Building upon the PCK model, Mishra and Koehler added the technological dimension, thus complicating the planning and teaching of content by integrating technology as a core component.

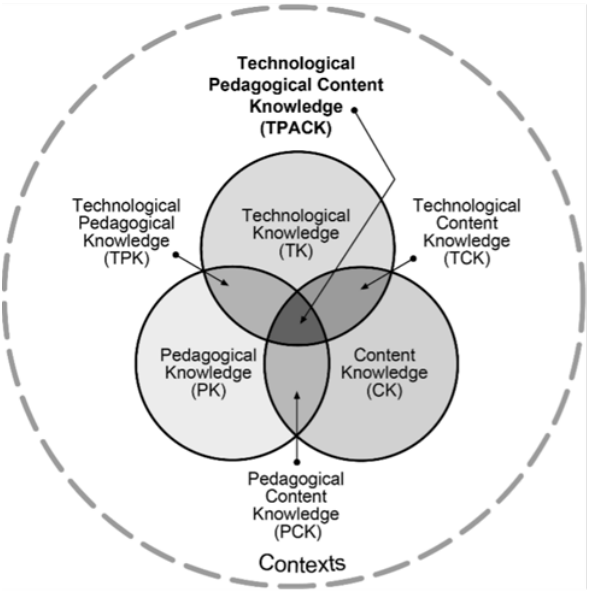

Figure 5: TPACK framework (Reproduced with the permission of the publisher, © 2012 by tpack.org)

The authors (Koehler and Mishra 2009; Mishra and Koehler 2006) present seven interrelated knowledge domains arising from the interplay of content, pedagogy and technology: 1) content knowledge (CK): understanding the core concepts, structures and methods of enquiry within a specific subject area; 2) pedagogical knowledge (PK): knowledge of general principles and practices of teaching, learning, assessment and classroom management; 3) technological knowledge (TK): understanding and effectively using digital and traditional technologies to support teaching and learning; 4) PCK: knowledge of how to teach specific content effectively by linking the subject matter with the appropriate pedagogical strategies; 5) technological content knowledge (TCK): awareness of how technology shapes and can be used to represent and explore particular content; 6) technological pedagogical knowledge (TPK): understanding how technology can transform pedagogical approaches and enhance learning processes; and 7) TPACK: the integrated understanding of content, pedagogy and technology that enables teachers to design effective and contextually determined instruction.

The authors point out that there is no technology solution that works for every teacher, student, subject or teaching style. Instead, successfully using technology depends on how well teachers can manage the complex balance between content, teaching methods and technology in their specific situations (Koehler and Mishra 2009). The model views teacher knowledge through its fundamental components (CK, PK, TK), their overlaps (PCK, TCK, TPK) and triad (TPACK), highlighting how complex and dynamic teacher knowledge really is. Recently, Mishra (2019) added another component – contextual knowledge (CxK), which includes understanding factors such as available technology, school policies and local or national policies. This addition shows how teaching is shaped by real-world conditions and organisational limits. Contemporary research has explored critical perspectives on TPACK, its application across specific subject domains and its role in teacher education and professional development, with particular attention to the aforementioned contextual knowledge and AI (Celik and Dogan 2025; Mishra et al. 2023; Phillips et al. 2025).

Teacher learning in terms of information and communication technology (ICT) integration can be viewed as a gradual process of meaning creation and transformation, which is consistent with constructivist theory. In this regard, Niess et al. (2009) identified five developmental levels of teachers' cognitive engagement with technology integration: recognising, accepting, adapting, exploring and advancing, each reflecting a progressive reconstruction of understanding through experience and reflection (Figure 6). The development of teacher knowledge occurs at the level of individual cognitive processes, considering existing knowledge and experience and resolving cognitive conflict. At the same time, the construction of TPACK is socially and contextually conditioned in the micro, meso and macro contexts (Porras-Hernández and Salinas-Amescua 2013). It involves collaborative learning in communities of practice and support in terms of scaling (Doering et al. 2009; Jang and Chen 2010; Zhang et al. 2019), formal professional development, a focus on authentic tasks and challenges in teaching practice and constant reflection on one's own practice, making the development of TPACK an iterative process.

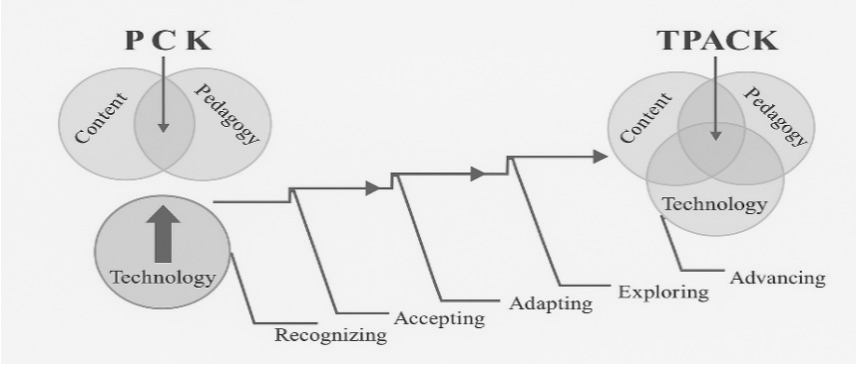

Figure 6: Visual representation of teachers' progressive integration of thinking and understanding within the TPACK framework (Niess et al. 2009, p. 10)

Integrating ICT changes the way teachers understand teaching. This idea fits well with Bruner's (1960/1999) concept of discovery learning, in which new knowledge occurs from rethinking what we already know. In TPACK, this occurs across six areas of knowledge. Learning communities, teacher collaboration and reflective practice have a positive impact on technology integration in teaching (Guzey and Roehrig 2009). Teachers have been shown to develop their TPACK by analysing their experiences, conducting action research and writing blogs or journal articles (ibid.). In that way, they reflect on their practices and the effectiveness of technology integration in their teaching, which allows for the modification of teaching. This shows that teachers develop their knowledge in social and educational environments where technology, pedagogy and content constantly interact with each other. Therefore, knowledge is not something fixed that a teacher possesses but is shaped by the situation and created by teachers as they navigate the circumstances of their classroom. This is why TPACK fits with constructivist ideas, especially with social constructivism and social epistemology, showing teacher knowledge as a shared, flexible and constantly developing concept.

Conclusion

The epistemological paradigm in the processes of learning and teaching has a strong correlation with normative science as the main theory of education and as one of the fundamental theoretical approaches in pedagogical science.

This paper offers an integrative framework that brings together elements of empiricism, rationalism, constructivism, pragmatism, critical rationalism and social epistemology. Teacher knowledge is presented as a fluid concept shaped by several traditions rather than a fixed category. The presented model highlights that teacher knowledge is always in motion because it grows through reflection, practice and interaction with others, thus providing us with a fuller picture of how teachers think, act and continue to develop professionally. Contemporary models, such as Shulman's PCK and Mishra and Koehler's TPACK, can also be seen through this wider epistemological lens: PCK draws mostly on empiricist and rationalist ideas and partly on constructivist ideas, while TPACK leans more towards constructivist and social-epistemological views of knowledge.

By framing teacher knowledge in this way, this paper argues for a more holistic understanding of it – one that recognises its complexity, flexibility and constant evolution. This kind of perspective underlines how important it is to keep theory and practice in dialogue, to keep learning throughout one's career, to self-reflect and to rely on a sense of pedagogical tact. All of this is crucial for the continuous development of teachers in the knowledge society. This approach supports an educational environment that reflects the constructivist principles underpinning modern education.

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ZNANJE UČITELJEV MED TEORIJO IN PRAKSO: EPISTEMOLOŠKA REFLEKSIJA

Povzetek: Znanje je temeljni element učiteljeve poklicne identitete in ključni dejavnik kakovosti izobraževanja. Ta teoretični članek si prizadeva raziskati epistemološko perspektivo učiteljevega znanja in jo reflektirati skozi vidik profesionalnega razvoja. Predstavlja integrativni okvir, sestavljen iz šestih medsebojno povezanih delov: empirizma (učenja iz izkušenj in opazovanja), racionalizma (pridobivanja znanja s sklepanjem in teorijo), konstruktivizma (gradnje znanja z interakcijo in kontekstom), pragmatizma (uporabe znanja za reševanje problemov), kritičnega racionalizma (glede na znanje kot hipotezo, preizkušeno v resničnem življenju) in socialne epistemologije (razumevanja znanja kot nečesa, kar se deli in ustvarja družbeno). Učiteljevo znanje se tako obravnava kot dinamična sinteza različnih epistemoloških tradicij. Posebna pozornost je namenjena sodobnim modelom učiteljevega znanja – Shulmanovemu pedagoškemu vsebinskemu znanju (PCK) ter Mishrovemu in Koehlerjevemu pedagoškotehnološkemu vsebinskemu znanju (TPACK). Ti modeli so interpretirani skozi širši epistemološki okvir. Sklepamo, da znanje učiteljev ni statična kategorija, temveč večdimenzionalen in prilagodljiv konstrukt. Izhaja iz dialoga med teorijo in prakso ter se razvija skozi vseživljenjsko učenje, refleksijo in profesionalno sodelovanje. Takšno razumevanje spodbuja inovativen profesionalni razvoj učiteljev v sodobni družbi znanja.

Ključne besede: konstruktivizem, epistemologija, pedagoško vsebinsko znanje, učiteljevo znanje, pedagoškotehnološko vsebinsko znanje

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