1 Teachers as knowledge professionals

The status of teaching as a profession has long been under scrutiny. Critics have commonly argued that teaching lacks a common body of knowledge that informs practice. This chapter sets the scene for an in-depth exploration of teaching as a knowledge profession. It presents arguments for considering teaching a full profession with teachers' pedagogical knowledge as its main pillar. The chapter also provides some examples of policies and practices that education systems have implemented to improve the knowledge base among the profession. It emphasises the role of empirical data in guiding such improvement processes and the need to go beyond the existing evidence. The final section explains the choice of topics covered in this publication.

Introduction

The ever-accelerating changes reshaping our economies and societies are major challenges for education systems and teachers. Modern teachers are expected to develop students' "21st century skills" in increasingly diverse classrooms. To be effective teachers need to base their practice on established theories and principals and the latest research on teaching and learning (Guerriero, 2017[1]). As societies and technologies constantly evolve, teachers must innovate teaching methods and pedagogies and continuously update their knowledge and skills.

The COVID-19 pandemic has demonstrated yet again how vital a strong and updated knowledge base is for tackling transformational challenges: It enabled teachers to swiftly change to online teaching and to adapt lesson plans, teaching approaches as well as their communication with students, parents and colleagues (OECD, 2020[2]). Constant changes, including abrupt transformational challenges similar to the COVID-19 pandemic, are a likely scenario for the future of education. Teachers need to be empowered to keep up with these changes, and to use educational transformations to innovate instructional methods and update their teaching skills. For this, teachers need to be owners of deep professional knowledge. A continuous renewal of the knowledge base is critical to teacher professionalism and the mastery of adaptive and transformative challenges.

This book sets out for an in-depth exploration of teaching as a knowledge profession with a particular focus on teachers' general pedagogical knowledge (i.e. teachers' specialised knowledge of teaching and learning independent of the subject taught). It brings together leading experts on teacher knowledge and large-scale assessments to share their ideas on how to study this knowledge across countries. This chapter sets the scene for the in-depth exploration: It presents arguments for considering teaching a profession with teachers' pedagogical knowledge as its main pillar. The chapter further emphasises the role of empirical data in guiding attempts to strengthen teacher knowledge across countries, in particular of international comparative data obtained through an assessment of teacher knowledge. It closes by explaining the choice of topics covered in the expert chapters.

Teaching is the mother of all professions

The categorisation of teaching as a profession, similar to medicine or law and other professions, has long been debated [see Guerreiro (2017[1]) for an overview of the discussion]. This is surprising as "teaching is in fact, the mother of all professions" (McDonald, 1956, p. 8[3]). Teaching builds the foundation and is the starting point for all professionals (Goodwin, 2011[4]). Teachers also shape society's future citizens and leaders, helping societies to thrive and individuals to reach their potential.

Effective teaching can be a real enabler of future academic and job careers. Teachers have been identified as the main contributors to student learning in schools and they are crucial for students' socio-emotional development and well-being (Burroughs et al., 2019[5]; Clinton, 2016[6]; OECD, 2021[7]). After all, the teachers are responsible for designing enriching learning environments, creating a classroom climate favourable for learning and personal growth, and facilitating the individual learning of students as well as the learning in groups. Teachers are also key agents of educational equity and inclusion. They are responsible for creating inclusive learning environments, and providing struggling students with the extra support needed to catch up with learning and integrate well in the school community (Ulferts, 2019[8]). To fulfil their roles as career enablers and equity agents, teachers need to be learning professionals, who base their everyday practice on an updated, coherent and integrated knowledge base (Guerriero, 2017[1]).

The pandemic-induced school closures have highlighted once more the crucial and irreplaceable role of teachers in education around the world. They have also made already existing challenges of teaching more visible, such as how to use technology effectively in teaching and how to ensure an inclusive and equitable

learning experience for an increasingly diverse student body. There is no doubt that tackling these challenges requires professionalism from teachers, in particular a strong body of knowledge.

For a long time, however, teaching was seen as a semi-profession (Guerriero, 2017[1]). The reasons for this are manifold but critics commonly argued that teaching lacks a common body of knowledge, practices and skills that constitute the basis for professional expertise and decision making. In their view, teachers have been unable to speak in a uniform voice about "what works, when and why" in teaching and how to define and identify quality teaching (Goodwin, 2011[4]).

For a while now, the focus of debates have shifted to a clear acknowledgement that teaching must be regarded a profession, with all that this implies for the knowledge, professional learning and status that is expected of a profession (see Box 1.1). However, it remains a major challenge in many countries to ensure teacher professionalism at large. A major concern is that too few teachers use existing scientific knowledge and evidence in their practice or base their teaching upon validated principles and theories. Nonetheless, there is a wide agreement that a common body of specialised knowledge exists that should inform teaching and should form part of teacher education and professional learning.

Box 1.1. The professional pillars of teaching in TALIS

Teacher professionalism is a changing concept, its meaning is tied to the social, historical and political context (Demirkasimoglu, 2010[9]; Snoek, 2010[10]; Wu, Cheung and Chan, 2017[11]; Goodwin, 2011[4]). Discussions around professionalism are often closely tied to the professional status and prestige of teaching (Guerriero, 2017[1]). The OECD Teaching and Learning International Survey (TALIS), for example, has recently defined five professional pillars of teaching (OECD, 2019[12]):

- **the knowledge and skills base**, including shared and specialised knowledge, as well as standards for entry into the profession and development of specific skills through initial teacher education and professional development
- **the status and standing of the profession**, captured through the ethical standards expected of teachers, the intellectual and professional fulfilment of the job, and the working regulations applying to teaching (such as competitive reward structures on par with professional benchmarks and room for career progression)
- **peer control**, which relies upon self-regulated and collegial professional communities that provide opportunities for collaboration and peer feedback to strengthen professional practices and the collective identity of the profession
- **responsibility and autonomy**, captured through the degree of autonomy and leadership that teachers and school leaders enjoy in their daily work, to make decisions and apply expert judgement and to inform policy development at all levels of the system, so that professionalism can flourish
- **the perceived prestige and societal value of the profession.**

The definition is based on the attributes of professionalism measured in the TALIS but also the policies and practices that support and enhance them. Though varying to some extent, other definitions commonly refer to a profession-specific, systematised and scientific body of knowledge that informs the daily activities of practitioners as a constituent characteristic of teacher professionalism (Demirkasimoglu, 2010[9]; Snoek, 2010[10]; Wu, Cheung and Chan, 2017[11]; Goodwin, 2011[4]; Guerriero, 2017[1]). Thus far, TALIS has relied on indirect measures of teacher knowledge through self-reports, for example teachers' feeling of preparedness for different teaching tasks, their participation in professional development and their need for further training. Such indirect measures of teacher knowledge have important limitations (further discussed in the section Going beyond the existing international evidence on teacher knowledge).

Pedagogical knowledge as a main pillar of teacher professionalism

As professionals, teachers have to base their judgements, actions and work-related decisions on a specialised and systematised body of knowledge, informed by research and practice (Guerriero, 2017[1]). Teachers need to use scientific knowledge and evidence to design and implement effective lessons. To justify decisions professional teachers use validated principles and theories. It is important that teachers regularly update their knowledge to the state-of-the-art on teaching and learning, as new insights emerge from practice and research or are shared through professional communities (Révai, 2020[13]; Boeskens, Nusche and Yurita, 2020[14]; OECD, 2019[15]).

There are good arguments for considering teacher knowledge, especially pedagogical knowledge, a main pillar of teacher professionalism. Firstly, existing definitions commonly refer to a specialised body of knowledge as a constituent characteristic of teacher professionalism, while other characteristics vary (see Box 1.1). Secondly, a profession-specific body of knowledge that informs practice is also used as a criterion to separate other professions such as doctors or lawyers from non-professions (Snoek, 2010[10]; Demirkasimoglu, 2010[9]; Guerriero, 2017[1]). Thirdly, a strong knowledge base and expertise are prerequisites for other elements of professionalism. For example, professions may be entrusted with higher levels of autonomy over their work, if they can assure a high level of expertise and knowledge and, thus, a high quality of practice and decisions (Goodwin, 2011[4]; Guerriero, 2017[1]).

Teaching is a complex task only mastered by a skilled and knowledgeable workforce. Teachers need to perform multiple tasks simultaneously: They monitor the class, encourage and provide feedback to individual students and groups and calm down disruptive or noisy students during group work. Naturally, the knowledge base this requires is also complex (see Box 1.2). To design and implement effective teaching and learning environments, teachers need to draw on various types of knowledge, including content knowledge (knowledge of the content and subject matter in mathematics, history, art etc.) and pedagogical knowledge (knowledge of how to create effective teaching and learning environments for students).

The importance of general pedagogical knowledge for teaching and professional exchange

There are also convincing arguments for a particular focus on teachers' pedagogical knowledge, in particular general pedagogical knowledge when exploring teaching as a knowledge profession. Pedagogical knowledge is unique to teaching and, therefore, distinguishes teachers from content specialist (e.g. a science teacher from a scientist or an art teacher from an artist) (Depaepe, Verschaffel and Kelchtermans, 2013[16]; Shulman, 1987[17]). Other than pedagogical content knowledge, which is subject-specific (e.g. the knowledge of creating effective teaching and learning environments in history, mathematics or biology), general pedagogical knowledge is the shared knowledge base of teachers across different subjects. General pedagogical knowledge refers to "the specialised knowledge of teachers for creating effective teaching and learning environments for all students independent of subject matter." (Guerriero, 2017, p. 80[1]). It, therefore, provides teachers with a common reflection ground and language to discuss their students' learning progress as well as well-being and ways to improve the teaching and learning support across subjects. Results from TALIS 2018 showed that across the OECD 61% of lower secondary teachers discuss the learning development of specific students at least once a month (OECD, 2020[18]). General pedagogical knowledge represents a powerful foundation for such discussions and professional exchange in general (OECD, 2019[12]).

Equally important, teachers' general pedagogical knowledge is a crucial resource for effective teaching and learning: An international review and meta-analysis found that general pedagogical knowledge relates to a higher teaching quality and better student outcomes (Ulferts, 2019[8]). Results indicated that more

knowledgeable teachers achieve a three-month additional progress for students. General pedagogical knowledge is also important for teacher well-being and job satisfaction (Voss et al., 2015[19]).

Box 1.2. Shulman's description of the knowledge base of teaching and further development

While different models exist, the most influential model describing the knowledge base of teachers was developed by Shulman in the late 80s (1987[17]; 1986[20]). Shulman divided teacher knowledge into seven categories:

- **General pedagogical knowledge** describes the knowledge of principles and strategies of classroom management and organisation that transcend subject matter.
- **Content knowledge** comprises the knowledge of subject matter and its organising structures.
- **Pedagogical content knowledge** represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised for instruction. It was described by Shulman as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (1987, p. 8[17])
- **Curriculum knowledge** includes the subject- and grade-specific knowledge of materials and programmes designed for the teaching of particular topics and subjects.
- **Knowledge of learners and their characteristics** subsumes the knowledge about cognitive, physical, emotional, social, historical and cultural factors, which account for students' needs and interests.
- **Knowledge of educational contexts** ranges from an understanding of teaching contexts and the social dynamics of classes and groups to a wider understanding of the governance and financing of schools and the characteristics of the school and community culture.
- **Knowledge of educational purposes, ends and values and their philosophical and historical foundations** includes teachers' knowledge about the wider purposes of school and the perceived needs of learners as well as the potential value of education to society as a whole.

The first three knowledge categories (i.e. general pedagogical knowledge, content knowledge and pedagogical content knowledge) have been widely used in the scientific literature but have been further developed over time (König, 2015[21]; Ulferts, 2019[8]; Fernandez, 2014[22]; Guerriero, 2017[1]). For instance, further research used slightly different terminologies and expanded the definition of general pedagogical knowledge to also include knowledge about learners and their characteristics or ways of assessing student's learning and outcomes. Guerreiro (2017[1]) proposed a definition broad enough to cover the areas of general pedagogical knowledge proposed by further research, defining it as "the specialised knowledge of teachers for creating effective teaching and learning environments for all students independent of subject matter" (p. 80[1]).

Beyond these three knowledge categories, little consensus exists. For example, Grossman (1990[23]) and Carlsen (1999[24]) include contextual factors as additional knowledge categories to stress the context boundedness of the teacher knowledge. While Carlsen distinguishes *knowledge about the general educational context* (factors relating to the wider context such as the nation and state, the community and school) from *knowledge about the specific educational context* (the contextual knowledge focused on the classroom and the students to be taught), Grossman subsumes both into a single category. Baumert and Kunter (2013[25]), on the other hand, propose *organisational knowledge* and *counselling knowledge* as additional knowledge categories.

Pedagogical knowledge for teaching in the 21st century and its context-adequate use

General pedagogical knowledge is also crucial for mastering emerging challenges in today's classroom such as the continuing digital transformation of education. Teachers' general pedagogical knowledge, in particular Technological Pedagogical Knowledge [TPK, plays an important role in designing effective online teaching and learning environments (see Chapter 3 for an in-depth discussion) (Lachner, Backfisch and Stürmer, 2019[26]; Mishra and Koehler, 2006[27])]. The COVID-19 pandemic has made the key role of general pedagogical knowledge for effective online teaching more visible than ever: Teachers that were more knowledgeable adapted their online teaching more to student needs and maintained frequent contact with students and parents during school closure (König, Jäger-Biela and Glutsch, 2020[28]). The increasing diversity in classroom is another enormous challenge of teaching in the 21st century and many education systems are striving towards greater inclusiveness (Schleicher, 2014[29]). More than ever, teachers need to know how to meet diverse needs and manage multicultural classrooms (König et al., 2017[30]; Wasonga, 2005[31]; Ulferts, 2019[8]).

Expert teachers are not simply owners of deep professional knowledge, they also know how to apply knowledge adequately in different pedagogical contexts and situations (Ulferts, 2019[8]; Guerriero, 2017[1]). Selecting the pedagogical theories, concepts and teaching approaches most relevant in and effective for a given classroom situation requires theoretical-scientific knowledge and practice-based knowledge but also professional judgement and knowledge-based skills (see Chapter 5 for an in-depth discussion):

- **Theoretical-scientific knowledge** summarises the abstract, academic knowledge of teachers (e.g. theories and concepts of teaching-learning processes or facts about effective instruction as well as classroom management).
- **Practice-based knowledge** refers to knowing how and when to apply such knowledge (e.g. a particular instructional strategy) in a given classroom context. This knowledge benefits particularly from experiential and practical learning (Ulferts, 2019[8]; Lenske et al., 2016[32]; Woolfolk Hoy and Schönplug, 2008[33]).
- **Knowledge-based skills** are important for the context-appropriate use of knowledge. Drawing on their knowledge, teachers need to *identify* and *interpret* situations and features in the classroom as decisive for teaching and learning, and, base their instructional *decisions* on such judgements (Stahnke and Blömeke, 2021[34]; Blömeke, Gustafsson and Shavelson, 2015[35]).

Policies and practices to support the pedagogical learning and exchange among teachers

The previous sections discussed that teachers need to acquire and continuously update their knowledge to be and remain effective. In the last few decades, education systems have enacted policies and reforms to ensure a solid knowledge base and a continuous update of knowledge and skills among the teaching workforce, for example:

- **Anchoring pedagogical knowledge in qualifications frameworks and professional standards:** Qualification frameworks and professional standards help signal what is expected from teachers and how they can improve at different stages of their professional careers (Gomendio, 2017[36]; Guerriero, 2017[1]). Knowledge in important pedagogical areas is a requirement or leading principal for designing and accrediting teacher education programmes as well as for entering and progressing in the teaching career and in several countries (e.g. Australia, Brazil, Chile, England, Estonia, Scotland) and even included in the UENSCO/TUAC Global Frameworks of Professional Teaching Standards (Révai, 2018[37]; UNESCO and Education International, 2019[38]; Guerriero, 2017[1]; UNESCO, 2015[39]).

- **Ensuring a sufficient coverage of pedagogical topics in initial teacher education and continuing professional learning:** Initial teacher education and continuing professional learning were restructured to ensure a coverage of important pedagogical content and incorporate new findings and insights into effective teaching and learning (Boeskens, Nusche and Yurita, 2020[14]; Tatto and Menter, 2019[40]; Tatto et al., 2018[41]; OECD, 2019[12]; OECD, 2019[15]). However, certain areas still seem underrepresented. Results from TALIS 2018, for example, showed that on average the use of ICT (information and communication technology) was only included for around half of lower secondary teachers (56%) in their formal education or training and teaching in a multicultural or multilingual setting for one-third of lower secondary teachers (34.8%) across participating OECD countries (OECD, 2019[12]).

- **Creating opportunities to experiment and probe knowledge in practice:** A major barrier to the use of scientific knowledge and research evidence is the "theory-practice gap" (Paniagua and Sánchez-Martí, 2018[42]; OECD, 2019[15]): Teachers struggle to apply the theories, principals and teaching and learning approaches acquired in training into their classrooms. This is particularly visible for novice teachers transitioning from initial teacher education to schools (something that is often referred to as the "practice shock"). Teachers need practical experiences and expert guidance to learn about the context-adequate use of knowledge (Ulferts, 2019[8]). This has been addressed by providing more opportunities to experiment and probe knowledge in practice during initial teacher education (e.g. during teaching practicum, modelling of pedagogical approach, video- and computer-based learning) as well as expert guidance and mentoring when novice teachers enter school (OECD, 2020[18]; OECD, 2019[15]).

- **Enhancing reflective practice and continuous engagement with research among the teaching profession:** Programmes and courses increasingly seek to also enhance teachers' continuous engagement with research (Tatto and Menter, 2019[40]; Boeskens, Nusche and Yurita, 2020[14]; OECD, 2019[15]). The goal is to plant the seed for lifelong learning of knowledge and skills in the profession. Many programmes, especially at initial teacher education institutions conducting research, teach skills and knowledge to identify and interpret relevant research and data adequately and to make it usable in their own classroom contexts. Programmes aim to stimulate reflective processes and systematic inquiry so that teachers actively shape their own professional learning and validate, affirm, and improve their practice A few institutions and initiatives have tried to promote "knowledge brokering" in education and translate knowledge and pack the information in ways that are user-centred (Wollscheid and Opheim, 2016[43]; Malin and Brown, 2019[44]). Others have tried to establish various forms of partnerships between research institutions and schools as a means to promote the use of research and data in schools and to increase the usability of research and to make scientific knowledge more actionable (OECD, 2019[45]; OECD, 2019[15]).

- **Supporting the knowledge exchange and collective reflection** among **teachers and schools:** Another approach to enhancing professional knowledge among the profession consists in promoting pedagogical exchange and co-operative learning among teachers and schools. Education systems have supported mutual exchange among teachers and schools and promoted regular joint discussions and reflections about pedagogical topics and experiences through various means [e.g. research learning networks, video study clubs, communities of practice and learning, lesson studies, learning walks, digital teaching networks, professional Facebook groups and instructional rounds, classroom visits and peer-coaching (OECD, 2020[46]; Révai, 2020[13])]. Results from TALIS 2018 have shown that the percentage of lower secondary teachers engaging in different forms of exchange and co-ordination for teaching (e.g. discussing the learning of students, exchanging teaching materials, attending team conferences) at least once a month varies between 40% to 60% on average across OECD countries, whereas a regular involvement in deeper forms of collaboration (e.g. joint teaching, collaborative professional learning) is less common (9 % to 28%).

- **Safeguarding the pedagogical preparedness of teachers from alternative routes:** Countries need to increase their efforts to safeguard the pedagogical preparedness of teachers entering into the profession through "alternative" routes (e.g. second career fast-track training, Teach for All). Such routes have been increased in many countries to tackle teacher shortage (OECD, 2019[12]; OECD, 2019[15]). In Queensland in Australia, STEAM (Science, Technology, Engineering and Mathematics and Arts) Teacher Education Centre of Excellence (STEAM TECE), provides with alternative routes to career changers with STEAM degrees in order to obtain the Master of Secondary Teaching. The rationale of the programme is to shorten the training of candidates but at the same time provide high quality trained mentors and a strong practicum and continuous contact with schools that partner with the programme (OECD, 2019[15]). An analysis of 129 alternative route programmes preparing elementary and secondary teachers in the United States revealed a general lack of sufficient support and guided practical experience to allow their students acquire pedagogical skills necessary for teaching (Graham Drake, 2018[47]). The 18 residencies studied, on the contrary, which are most often multiple-year programs that require coursework on par with traditional preparation, received overall positive evaluations.

These overviews demonstrate commonalities but also important differences in policies and practices and their impact on teacher knowledge varies. Thus, ensuring a solid and updated knowledge base among the profession at large remains a concern for many education systems.

Studying teacher knowledge across education systems

The value of an international teacher knowledge study for policy and practice

To ensure that policies have desired effects, their intended outcomes need to be measured. Several studies have assessed teacher knowledge, demonstrating that initiatives such as the ones previously mentioned can be effective in supporting teachers in acquiring and enriching their professional knowledge. For instance, Gess-Newsome and colleagues (2019[48]) showed a growth in teacher knowledge, including general pedagogical knowledge, of high school biology teachers in the United States participating in a two-year professional development intervention that included educative curriculum materials. König (2013[49]) found that the more future primary teachers in Germany advanced in their studies the more general pedagogical knowledge they had acquired. More scientific-declarative knowledge was gained predominantly during the more theoretical first phase of German teacher education and practical knowledge through the practical second phase. Similar results have been obtained for a comparison of different course formats in a teacher education programme in Germany (Stürmer, Könings and Seidel, 2013[50]). Highest gains in terms of declarative general pedagogical knowledge and knowledge-based skills were obtained in a course that used video-based learning as a means to train the application of knowledge in different teaching contexts. Despite promising results for these and other initiatives [see also (Voss et al., 2015[19]) for an overview], evidence for many initiatives is missing and the existing evidence is often drawn from rather small samples. It is unclear if such initiatives can be scaled-up on a national- or region-level with similar results. Not least because their transferability to other regions let alone countries with the same effects is uncertain.

Ensuring a solid and updated knowledge base among the teaching profession at large requires large-scale assessments of teacher knowledge, optimally using representative samples. Some education systems use assessments for certifying teachers and ensuring that *all* teachers have acquired sufficient knowledge upon entry into the profession, for example almost all states in the United States (Demonte, 2017[51]; Bonsu, Bowman Carolee Dodge Francis and Eric Larsen Rebecca Polar, 2013[52]). Others use assessments to promote professional growth among in-service teachers. Chile, for instance, implemented a formative teacher evaluation that ties evaluation results to professional development and salary increments (Santiago et al., 2013[53]; Avalos-Bevan, 2018[54]). A few attempts have been made, to use

these national assessments to address key questions regarding teacher knowledge such as evaluating the knowledge gains of teacher education programmes (Darling-Hammond, Newton and Wei, 2010[55]) its relationship to the quality of lesson preparation and practice as well as student outcomes (Santelicesa and Tautb, 2011[56]; Cowan and Goldhaber, 2014[57]).

Expanding the study of teacher knowledge beyond national boundaries promises unique merits:

- An international study allows for a better understanding of the national and regional contexts of teacher knowledge (e.g. the system of initial teacher education and continuous professional learning), and, thus, the context boundedness of results obtained through national assessments or research studies.

- Through participation in an international study on teacher knowledge, countries and economies become part of an international education community that aims at globally improving teacher quality informed by evidence on the strength and weaknesses of teachers' knowledge base. Through participation, schools and teachers become part of a professional community that inspires learning on how schools and practitioners in other countries and regions support knowledge exchange and co-construct. They make a valuable contribution to the education community both nationally and internationally and help improve teacher policy and decision making in schools and institutes involved in teacher education and professional learning.

- Domestically, such a study can provide information on how well systems are providing schools in different geographic areas (e.g. urban and rural areas, including remote areas) as well as socioeconomically advantaged vs. disadvantaged schools with highly skilled and knowledgeable teachers.

- An international study that highlights the complex nature of teaching and the specialised knowledge it requires has the potential to strengthen the professional status and the societal value of teachers. Results from international studies are distributed internationally and discussed widely by different stakeholders of school education.

Going beyond the existing international evidence on teacher knowledge

The OECD Teaching and Learning International Survey (TALIS) has increased the public attention for the key role of teachers for quality education. It gave impetus to an evidence-based reflection on teacher professionalism and collective efforts to increase teacher quality across countries (OECD, 2020[18]). TALIS defines the knowledge and skill base of teachers as one of the five pillars of teacher professionalism (see Box 1.1).

Thus far, TALIS has relied on indirect measures of teacher knowledge through self-reports, for example teachers' feeling of preparedness for different teaching tasks or their participation in professional development and need for further training. Yet, there is evidence suggesting that assessed and self-reported knowledge are measuring distinct teacher characteristics. For instance, König and colleagues (2012[58]) found no significant or only low correlations between pre-service teachers' feeling of preparedness for different teaching tasks and their assessed general pedagogical knowledge in Germany and the United States. Similar results were observed for teachers' assessed vs. self-reported pedagogical knowledge for an effective use of technology in teaching (Baier and Kunter, 2020[59]; Drummond and Sweeney, 2017[60]; Maderick et al., 2016[61]). The accuracy of teachers' judgements about one's own knowledge and skills may be a professional competence in itself that probably grows with experience and expertise of the teacher (Ulferts, 2019[8]).

In the 2024 cycle, a new optional TALIS module will study teaching as a knowledge profession across countries. The Teacher Knowledge Survey (TKS) assessment module will complement the TALIS self-report measures (e.g. teachers' feeling of preparedness for different teaching tasks) with an objective

assessment of the strength and weaknesses of teachers' knowledge across countries, delivering a new, innovative theme and set of indicators for TALIS 2024.

Two international studies on teacher knowledge exist but have important limitations. The international large-scale study Teacher Education and Development Study in Mathematics (TEDS-M), carried out by the International Association for the Evaluation of Educational Achievement (IEA), assessed for the first time teachers' professional knowledge across countries, including content knowledge, pedagogical content knowledge and general pedagogical knowledge (Tatto, 2013[62]). The Study was used as a tool to inform and develop teacher preparation policies for pre-service mathematics teachers (Tatto et al., 2018[41]). Yet, TEDS-M focused on knowledge as an outcome of initial teacher education and, thus, measured the knowledge of pre-service teachers at the end of teacher training. Equally important, general pedagogical knowledge was only assessed for pre-service teachers of mathematics in three education systems (Chinese Taipei, Germany, USA) and results are outdated (data collection took place in 2007/08) (König et al., 2011[63]).

The Service Delivery Indicators (SDI), an initiative launched by the World Bank in partnership with the African Economic Research Consortium and the African Development Bank, collected data on service delivery in schools and health facilities, including teacher knowledge (Bold et al., 2017[64]). The study assessed content and pedagogical knowledge of teachers but only in primary schools in seven Sub-Saharan African countries—Kenya, Nigeria, Mozambique, Senegal, Tanzania, Togo, and Uganda.

The OECD's TKS assessment module will go beyond the existing international evidence by assessing the knowledge of in-service lower secondary teachers. Focusing on general pedagogical knowledge, it enables to study teacher knowledge across not only countries but also subjects, enabling a collective reflection on how to strengthen the acquisition, refinement and exchange of pedagogical knowledge within the profession. The focus on in-service teachers allows insights into how the knowledge base of teachers has been shaped through not only initial teacher education but also subsequent professional learning and teaching experience.

The module can build on substantial prior work within the Centre for Education Research in Innovation (CERI), where it was originally developed as a stand-alone survey as part of the Innovative Teaching for Effective Learning (ITEL) project. The development of the Teacher Knowledge Survey (TKS) was embedded into a broader research agenda on teacher knowledge and quality that informed the survey development (see Box 1.3 for a project overview).

Box 1.3. OECD/CERI Innovative Teaching for Effective Learning (ITEL) project

The OECD/CERI Innovative Teaching for Effective Learning (ITEL) project was designed to provide insights about teaching in the 21st century, and more specifically about teaching as a knowledge profession. The ITEL project has conducted extensive conceptual, development and empirical work on two strands, addressing three main policy challenges:

- How can we improve pedagogy for more effective learning?
- How can we improve teacher learning for more effective teaching?
- How can we improve the selection and retention of teachers?

Strand I: Research on 21st century teaching and learning

Drawing on multiple research perspectives, the ITEL Research Strand examined the complexity and the changing nature of the teaching profession to understand better the different factors underlying high quality teaching in light of 21st century demands. It provided a modern account of teachers' professional competence and a sound conceptual basis for investigating their pedagogical knowledge (Guerriero, 2017[1]). A systematic review and meta-analysis of empirical evidence revealed significant relationships between teachers' general pedagogical knowledge and teaching quality as well as student outcomes (Ulferts, 2019[8]). Révai (2018[37]; 2020[13]) examined how knowledge manifests in teaching standards and in initial teacher education, and investigated the role of networks in the dynamics of professional knowledge. Kuhl and colleagues (2019[65]) showed how recent multidisciplinary research can inform educational practice and policy making, including neuroscience, the social, cognitive and behavioural sciences, education, computer and information sciences, artificial intelligence/machine learning, and engineering. Further publications offered specific examples of the potential of neuroscience in the area of mathematical and spatial cognition, and science, technology, engineering and mathematics (STEM) learning (Newcombe, 2017[66]; Looi et al., 2016[67]).

Strand II: The Teacher Knowledge Survey (TKS)

The OECD/CERI Teacher Knowledge Survey (TKS) was designed as a stand-alone study to explore teaching as a knowledge profession in the 21st century (Sonmark et al., 2017[68]). The TKS aimed at gaining insight into the strengths and weaknesses of teachers' *general pedagogical knowledge* in different contexts. It also sought to explore the scope and quality of their learning opportunities as well as aspects of motivational and affective competencies and their relationship with teacher knowledge. In its original version, the survey sampled teachers from the same schools as well as teacher educators and pre-service teachers from the same initial teacher education institutions to allow for an in-depth analysis of effects of the school context and institutional environment.

The TKS has now been integrated into TALIS as an optional module: the Teacher Knowledge Survey (TKS) assessment module. The module can build on the substantial prior work within CERI. In continuous collaboration with experts as well as countries and economies, the ITEL project has developed, piloted and refined the study design, including the conceptual and assessment frameworks, instruments, sampling framework and recruitment methods (further detailed in Chapter 2).

Overview of this publication

This publication aims to contribute to the discussion of teaching as a knowledge profession and the challenging endeavour of studying teacher knowledge across education systems. It brings together leading experts on teacher knowledge and large-scale assessments to share their ideas on how to explore

teaching as a knowledge profession in international surveys and strengthen their relevance for guiding teacher policies and practices. Each chapter summarises the scientific literature on a particular key topic relating to the research on teacher knowledge:

- **Chapter 2** provides an overview of the new TALIS Teacher Knowledge Survey (TKS) assessment module, including a description of its aims and design as well as its conceptual underpinning and instruments.

- **Chapter 3** discusses the knowledge and skills teachers need to master a major challenge of teachers in today's classrooms: the effective use of technology to facilitate student learning. It includes suggestions for conceptualising and measuring this knowledge in a cross-country survey, as well as for collecting information about the broader context of teachers' technology-related knowledge and skills: Teachers' use of technology in teaching, their self-efficacy and the overall conditions for technology use at school.

- **Chapter 4** focuses on the pressing issue of preparing and supporting the teaching workforce for high quality teaching in increasingly diverse classrooms. This chapter discusses how an international survey can provide deeper insights into teachers' competences for inclusive and multicultural education.

- **Chapter 5** aims to contribute to a better understanding of the theory-practice divide commonly described for teachers: Teachers, especially novice teachers, are often unable to make use of acquired knowledge in their classrooms and to base their professional judgements and decision making on available evidence and best practice. A contextualised assessment of teacher knowledge with an innovative scaling and scoring approach is proposed to understand better the knowledge and skills teachers need for knowledge-based and evidence-informed practice.

- **Chapter 6** highlights the role of initial teacher education, induction and continuing professional development in helping the profession overcome the theory-practice divide. It makes concrete suggestions for measuring such practical opportunities to learn about pedagogy that facilitate knowledge-based instruction in schools.

- **Chapter 7** is dedicated to innovative testing designs for exploring teacher knowledge across countries. The chapter proposes a multidimensional adaptive testing design to reduce the length and optimise the precision of such surveys while increasing the test-taking motivation of participating teachers, which is crucial in light of increased survey burden and teachers' limited time for extra tasks. A Monte Carlo simulation study shows how such an innovative design could increase the test efficiency of the Teacher Knowledge Survey (TKS) assessment module.

- **Chapter 8** outlines the main takeaways from the chapters and embeds the raised issues into a broader discussion around researching and improving the knowledge of the teaching workforce in education systems around the globe. It outlines areas for further research and discusses how teacher policy, professional exchange and knowledge-based practice in schools can be strengthened drawing on teacher knowledge research.

The work on the Teacher Knowledge Survey (TKS) and its integration into the into the Teaching and Learning International Survey (TALIS) was guided by the CERI and TALIS Governing Boards, which were also invited to a meeting to discuss the topics covered in this publication. An expert group in collaboration with participating countries and economies, the TALIS Governing Board (TGB) and important stakeholders will be involved in the further development of the module. The aim of the development process is the design of a survey that provides information on key areas of teacher knowledge meaningful for participating education systems, schools and teachers, while keeping the participation burden limited. The expert reflections of this publication can be used as a stimulus for the joint discussions and collaborative effort of studying teaching as a knowledge profession across countries.

Concluding note

This publication sets out for an in-depth exploration of teaching as a knowledge profession. It aims to contribute to the discussion on the knowledge needed for teaching in the 21st century and the challenging endeavour of studying teacher knowledge across education systems. It summarises the scientific literature on key topics relating to teaching in today's classrooms: the use of research and scientific knowledge in practice, an effective integration of digital technologies in teaching, and ensuring an inclusive and equitable learning experience for an increasingly diverse student body.

The publication also entails specific suggestions for researching these topics across education systems. It provides an overview of the new OECD Teacher Knowledge Survey (TKS) Assessment Module, which will collect international comparative data on teacher knowledge in the next cycle of the Teaching and Learning International Survey (TALIS). Research on teacher knowledge can be used for informing teacher policy and strengthening professional exchange and knowledge-based practices in schools. In the end, the success of any research endeavour is also determined by the contribution made to improving policy and practice.

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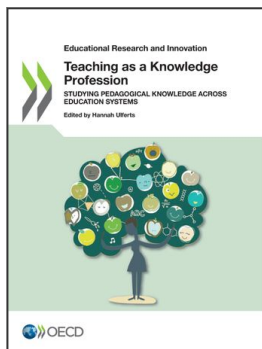
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