6 Studying opportunities to learn general pedagogical knowledge along the teaching career

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This chapter is dedicated to the learning opportunities that enable knowledge-based practice of teachers. It also contributes ideas for measuring such learning opportunities along the teaching career, drawing on existing cross-country research. This includes concrete recommendations for how to extend the TALIS 2018 teacher questionnaire and the TKS assessment module for an in-depth study of teachers' opportunities to learn general pedagogical knowledge in future cycles. The chapter ends with implications for further research on the learning opportunities needed to ensure knowledge-based practice in schools.

Introduction

Despite the importance attributed to general pedagogical knowledge (GPK) for effective quality teaching, the degree to which teachers universally acquire such knowledge is still an open question (Tatto, 2018[1]; Ulferts, 2019[2]). Further, while teachers are exposed to a wide range of opportunities to learn during their initial teacher education (ITE), induction, and during their careers, once they become teachers of record, there is much to learn about which of these are the most effective and how they complement each other.

Finding answers to these questions is a very complex undertaking given the norms of the different institutions at play and teachers' own life experiences. It is well established that teachers learn about teaching through the 'apprenticeship of observation', that is, by watching their teachers for more than 10 000 hours during their schooling (Lortie, 1975[3]). The powerful influence of such an apprenticeship is hard to challenge in ITE. There is evidence, however, that ITE programmes located in universities (where teachers have ample opportunities to study the subjects they will teach, the pedagogy of their subject, and general pedagogy plus a practicum) can produce highly knowledgeable teachers (Tatto et al., 2012[4]; Tatto, 2018[1]). Also, programmes that are internally coherent and provide opportunities to learn (OTL) within an inquiry-based model (e.g. emphasis on problem-solving through action research to explore productive ways to teach subject matter to diverse pupils including planning, adaptations to curriculum design and implementation, assessment of student progress, and classroom organisation) are effective in challenging deeply held beliefs about teaching and learning (Tatto, 1996[5]; Tatto, 2018[1]).

The *practicum* component of ITE presents special challenges, particularly if the norms of ITE programmes and those of the schools where the practicum is to occur are at odds. The practicum, however, also offers important opportunities to learn to teach because it focuses on three essential aspects: the situated learning experience about pupils, classrooms and what it means to be a teacher; the learning that occurs as a result of planning, instruction, and assessment; and the extent to which teachers' actions best help pupils learn and enhance their capacity to continue learning. Research has shown the importance of well-structured practicum experiences for teaching knowledge. Of particular importance are opportunities to engage in action research under continuous mentoring or supervision from experienced and committed teachers (Peralta and Tatto, 2018[6]). Also, successful practicum experiences require strong working partnerships and supportive mentoring in both programmes and schools able to provide future teachers OTL that are mutually consistent and productive (Tatto et al., 2018[7]; Zeichner, 1996[8]).

While not universally implemented in schools, an induction period for early career teachers provides important OTL at this crucial stage in teachers' careers. Research shows that intensive mentoring focused on content and instruction, management, and student engagement seems to be a key component mediating OTL and teaching quality improvement among early career teachers (Stanulis and Floden, 2009[9]; Kane and Francis, 2013[10]; Hammerness and Matsko, 2012[11]).

Much emphasis has been placed on professional development (PD) for teachers, not only as a way to promote continuous learning and professional improvement but also as an important factor supporting the implementation of curricular reforms, including the introduction of new standards and increased accountability. Research shows that well-structured substantive PD opportunities can improve teaching practice with important positive consequences for pupil learning (Yoon et al., 2007[12]; Darling-Hammond, Hyler and Gardner, 2017[13]). Moreover, PD that emphasises leadership, autonomy, collaboration and substantial feedback on teaching practices seems to be a successful way to not only improve teaching practices but to build communities of practice within schools (Gore et al., 2017[14]).

The OECD, through the Teaching and Learning International Survey (TALIS) teacher questionnaire and the Teacher Knowledge Survey (TKS) assessment module, is planning to investigate the complex dynamic relationship between the continua of OTL and learning outcomes for teachers in ITE, induction and PD. This will help in beginning to understand how to contribute to build a robust knowledge base for the profession.

This chapter contributes new ideas, advances and specific feedback on the 2018 TALIS and TKS frameworks and teacher questionnaire, concerning the conceptualisation, definition and measurement of secondary teachers' OTL GPK.

The chapter has three sections. It first examines promising concepts and supporting strategies that may allow the development of a profile of OTL GPK for secondary teachers in ITE including courses and the practicum, induction and PD. This section also briefly introduces key studies that may contribute to a solid theoretical basis for TALIS and TKS assessment module. The next section provides suggestions for profiling teachers' opportunities to learn. The last section concludes with concrete recommendations for how to extend the TALIS 2018 teacher questionnaire and the TKS assessment module for an in-depth study of teachers' OTL general pedagogical knowledge in future cycles. It also reflects on the further research that is needed to support building the knowledge base of the teaching profession.

Concepts and strategies for exploring teachers' opportunities to learn

While OTL occurs in fluid ways through both formal and non-formal experiences for teachers, it is widely acknowledged that the three phases of development described above (ITE, induction, and PD) are likely to occur through teachers' careers. Drawing on international studies (see Box 6.1), the chapter will use these phases to organise the suggestions of important concepts, methodological advances, and indicators of OTL lead to essential knowledge for teachers with a particular emphasis on GPK.

Box 6.1. Existing cross-country studies on teachers' opportunities to learn general pedagogical knowledge

The Teacher Education and Development Study in Mathematics (TEDS-M) is the first and only study that has surveyed representative samples of teacher education programmes, their future teachers and their teacher educators in 17 countries. The study proposed to explore mathematics content knowledge, pedagogical content knowledge, general pedagogical knowledge, background, beliefs, and opportunities to learn among future primary and secondary teachers close to graduation (Tatto, 2013[15]).

The First Five Years of Mathematics Teaching study (FIRSTMATH) explored novice teachers' development of mathematical knowledge for teaching, and the influence that previous preparation, school context and opportunities to learn-on-the-job have on that knowledge. FIRSTMATH explored the connections between opportunities to learn in pre-service preparation and what is learned on the job as it concerns knowledge, skills and curricular content. Additionally, the study analysed the degree to which standards, accountability and other similar mechanisms operate to regulate the support that beginning teachers of mathematics at the primary and secondary levels receive (Tatto et al., 2020[16]).

While TEDS-M and FIRSTMATH focused on mathematics, an important concern in both studies was with general pedagogical knowledge and the diverse opportunities to learn teachers encounter in initial teacher education programmes, induction and professional development, and their connection to practice. For instance, two-thirds of the opportunities to learn questions in both studies directly focus on general pedagogical knowledge.

The Learning to Teach in England and the United States study (LTTE-US) is a small-scale observational study that explores the challenges that teachers encounter in their practicum and the extent to which policy and practice in teacher education programmes and schools mediate initial teaching practice among secondary teachers. This study explored general pedagogical knowledge across different subjects and settings (Tatto et al., 2018[7]).

The recommendations in this section draw primarily from experiences in two large-scale international comparative studies. These are the Teacher Education and Development Study in Mathematics (TEDS-M) (Tatto, 2013[15]; Tatto, 2018[1]) and the First Five Years of Teaching Mathematics (FIRSTMATH) (Tatto et al., 2020[16]). Additionally, a comparative observational study, called Learning to Teach in England and the United States (LTTE-US) (Tatto et al., 2018[7]), is drawn upon. Recommendations are also based on insights of effective PD (Darling-Hammond, Hyler and Gardner, 2017[13]) and PD that builds on professional communities of practice (Gore et al., 2017[14]). Insights from other relevant studies are included as well.

The TALIS 2018 teacher questionnaire (TQ) asked teachers several questions about OTL (Ainley and Carstens, 2018[17]). These included questions relating to ITE (TQ-06, TQ-15), PD and induction (TQ-19-23, TQ-25-28), feedback (TQ-29-Q31) as well as learning communities (TQ-32-33). Answers provided information to draw profiles of teaching practices, understand teachers' collaborative experiences (professional learning communities and communities of practice), and whether these practices and experiences resulted in innovation, equity and attention to diversity. TALIS 2018 pursued the following aim:

> *'TALIS 2018 will collect information that should enable the construction of initial teacher education (ITE) profiles and allow in-depth analyses of the effects of these profiles on outcomes such as GPK among lower secondary school teachers. The link between ITE and continuous professional development is of particular interest. Understanding the different ITE profiles that lead to teaching and their association with these outcomes is highly relevant….' (Ainley and Carstens, 2018, p. 41[17]).*

With this aim in mind, the following section outlines ways to extend the existing TALIS 2018 teacher questionnaire and the analytical potential indicators for ITE, for PD and induction to allow for more fine-grained profiling of teachers' OTL GPK in future cycles. An analysis of whether and how these indicators measure GPK OTL is important as they have the potential to explain key elements of high quality teaching and teacher professionalism as outlined in the TALIS framework.

Grounding the measurement of ITE opportunities to learn in teacher education practice

To be able to understand and describe OTL in ITE, it is important to ground the development of measures on programmes' theory of action. Because the TEDS-M study was the first international comparative study of ITE, it was considered essential to ground the indicators and measurement of OTL on the design of the teacher education curriculum in the participating countries (Tatto, 2013[15]). While participants provided much information via interviews and questionnaires, the research team decided to carry out an analysis of course syllabi drawing from a representative sample of programmes in each country (Tatto and Bankov, 2018[18]; Tatto, 2013[15]).

The product of the syllabi analysed included coding the topics covered in courses on subject content, pedagogy of the content, general pedagogy and practicum. The syllabus analysis was used to make explicit the diverse OTL provided to future teachers, to arrive at clear definitions that were agreeable across countries, and to finally develop the OTL items drawing on the topics and subtopics from the analysis. The syllabus analysis was not only a strategy to develop definitions and to build items and indicators, but to develop capacity among teacher educators to analyse and reflect on the larger teacher education curriculum. Table 6.1 contains the list of topics covered in GPK courses.

Table 6.1. General pedagogy topics and subtopics across ITE programmes in TEDS-M

Topics covered in ITE courses	
History of Education and Educational Systems • characteristics of development and international systems (not your country) • historical development of the national system	Principles of Instruction • instructional theory and instructional design • didactic/teaching methods and models • lesson planning
Educational Psychology • motivational theory • theories of psychological development, cognitive development, and intelligence • learning theory • teaching and learning with the framework of multiple intelligences	Classroom Management • theory of classroom management • management of classroom community and learning environment classroom rules and handling of improper behaviour
Philosophy of Education • philosophy of education and general philosophy • knowledge and appreciation of educational theory (including meaning of educational goals) • educational ethics and moral education • education and epistemology • education and humanism	Assessment and Measurement Theory • types and functions of assessment • purposes, reliability and validity of assessment • analysis and design of examinations
Sociology of Education • social status of teachers • purpose and function of education in society • organisation of current educational systems • organisation and culture of schooling and school • social conditions, social change, social development, social resources and school education • diversity (e.g. knowing how to teach students of different abilities/cultures including Indigenous people, cultural, language, gender and special needs) • educational policies, reform, and current educational issues • comparative education relations of education and other topics (including culture, economy, society, politics)	Counselling, Advising Students, and Pastoral Care • basic theories and models in counselling • professional ethics of counselling training for skills and ability of counselling
Introduction to Education or Theories of Schools • goals of schooling (institution of schooling) • purpose and function of education • role of teacher • curriculum theory and theory of curriculum development • teacher-student relations • school administration and leadership (including personnel management, school finance, etc.) • education and legal issues • teacher professional development	Instructional Media and Operation • theories of media design • developing skills and abilities for media design • use of ICT and other media to support instruction
Methods of Educational Research	
Topics covered in the Practicum	
• knowing how to teach students of different abilities • knowing how to teach students with different linguistic, cultural and economic backgrounds and special needs • demonstrating moral responsibility toward diverse pupils • using assessment and similar data in making decisions regarding students • knowing how to motivate students	• identifying/differentiating learning styles • knowing how to develop lesson plans • knowing various forms of classroom assessment • knowing how to structure content • knowing how to manage classroom discourse • demonstrating strategies to deal with behaviour problems (ex: aggression) • knowing how to communicate and/or engage parents • engaging in general cooperation among teachers (e.g. marshalling resources at school)

Source: The intended, implemented and achieved curriculum of mathematics teacher education (Tatto and Bankov, 2018[18])

Similarly, TALIS could conduct a syllabus analysis to construct OTL items attuned to the current curriculum in teacher education, induction and PD. While the items developed by TEDS-M have proven valid for the newer FIRSTMATH study (Tatto et al., 2020[16]), TALIS includes a much larger number of countries. Furthermore, the last ten years have seen increased immigration across the world among many other changes. This requires teachers to develop skills to address the learning needs of children from diverse cultures. Additionally, the current COVID-19 pandemic is likely to have altered the teacher education curriculum, particularly concerning important aspects such as the use of information and communication technology (ICT) in classrooms, as well as an increased emphasis on socio-emotional learning. While the OECD has released recent work on ITE and PD e.g. A Flying Start (OECD, 2019[19]), the ongoing Teachers' Professional Learning Study [TPL] (Boeskens, Nusche and Yurita, 2020[20]), this work is policy-focused and did not have the scope to carry out a topic analysis of the teacher education curriculum, the induction curriculum or the PD curriculum.

Acknowledging the progressive and practical nature of teachers' learning in ITE

There has been much research on the optimal combination of courses and practical experiences that future teachers need to become effective (Darling-Hammond et al., 2010[21]; Jensen et al., 2019[22]; Seidel and Shavelson, 2007[23]). There is general agreement that the kind of teachers required to promote a 21st-century education are professionals who can implement inquiry-based teaching and inquiry-based learning. In inquiry-based learning, teachers must know their subjects deeply so that they can guide their students through the fundamental concepts and nature of these subjects. Typical characteristics of inquiry-based teaching and learning are, for example, critical and collaborative classroom communities that emphasise active learning of students, and the capacity of students to investigate and research their own questions. Learning to engage in teaching in this manner challenges the traditional role of the teacher as someone whose practice is primarily lecturing. Inquiry-based teaching is not something that can be learned in short courses. A significant period of learning, observation and mentored practise is needed.

The most helpful suggestion regarding the learning progression of inquiry-based teaching including courses and practicum was offered by McIntyre back in the early 1990s, and occurs at three levels: technical, practical, and critical or emancipatory (1993[24]) (see Box 6.2).

Two main theoretical disciplines are seen as essential to support teachers' practical theorising. Learning to think logically and conceptually to question the meaningfulness of concepts and to uncover hidden assumptions and implicit value judgements in the task of teaching and learning. The second is the use of theory developed from empirical research as applied to the practice of teaching. In sum, McIntyre emphasises the importance of action research and other education-based research engaged by teachers and educators to inform knowledge for teaching, and for learning to teach.

Finally, McIntyre (1993[24]) argues that the integration of theory and practice in initial teacher education depends on having a 'core curriculum' negotiated around the tasks of teaching that are agreed to be the most important for both university and school educators.

In designing the TKS assessment module and refining TALIS to profile ITE OTL, it would be important to consider the three phases of teachers' formation (described in Box 6.2) and the OTL they provide teachers in these phases as recommended by McIntyre (1993[24]). More detail describing useful scales and sub-scales including what the items measure is outlined below.

Box 6.2. Learning progression of inquiry-based teaching

Rather than beginning with theoretical courses, the *technical* is first emphasised as is the progressive attainment of short-term goals. Future teachers must be able to know the basics of what the role requires according to standards of good practice such as 'achieving and maintaining classroom order and purposeful activity, gaining pupils attention and interest, ensuring that pupils know what they are expected to do, that they understand the content of the lessons, etc.' (McIntyre, 1993, p. 45[24]). Planning is an important aspect of these basic skills and it is understood as mediated by teachers' understanding of their pupils, their context, and teachers' skills and commitments. When planning, teachers must resort to a wide repertoire of concepts and ideas emerging from their discipline and must engage in the challenging task of what McIntyre calls practical theorising (or anticipating how students will receive the lesson, how well it would go and how much would be learnt). Once this phase is completed, teachers can move on to the practical and emancipatory phases.

The key task in the *practical phase* is for teachers to be able to self-evaluate their practice and its consequence (most importantly its effect on students' learning). This phase requires the development or adoption of standards or criteria that will be used to collect evidence to self-evaluate and to correct courses of action—an important question for teachers in this phase is what are the results of the practical theorising that occurred before, during and after the lesson, how does the nature of the subject, students' styles of learning, and the school curriculum interact with the teaching and learning dynamic.

The third phase which McIntyre called the *critical or emancipatory phase* is at the core of inquiry-based teaching. In this phase, teachers begin to understand the contradictions inherent in institutional and social structures which may conflict with serving the best interests of students and with teachers' professional commitments. McIntryre asserts that these conflicts will invariably arise during the programme courses, but more intensely once teachers are in their practicum. The key task in this stage is to develop strategies to analyse, reflect and even contest norms and mandates that may be at odds with the essential task of teaching and learning.

Source: (McIntyre, 1993[24])

Fostering learning communities of autonomous professionals

Teachers' professional development OTL typically have been short-term experiences created to engage teachers in curriculum reform or assessment exercises. These have been disconnected from and inconsistent with the task of teaching and learning (Darling-Hammond, Hyler and Gardner, 2017[13]). The work of Kennedy is particularly relevant for expanding on teachers' OTL in TALIS (2004[25]; 2016[26]). Based on her qualitative work on teaching, Kennedy argues against the increasing focus on lists of core practices to characterise teaching and inform teacher education (Grossman, Hammerness and McDonald, 2009[27]) and proposes five 'universal goals' of teaching that need to be addressed in teacher education and professional development.

Kennedy's (2016[26]) five goals of teaching provide a road map for thinking about ways to re-imagine OTL GPK and extending McIntyre's (1993[24]) conceptions. Teachers need to know:

1. to portray curriculum content in a way that enables young minds to comprehend it
2. to enlist student participation
3. to expose students' thinking *at* the moment
4. to contain student behaviour
5. to do all of this in a way that is consistent with teachers' professional commitments in constructing a conducive teaching and learning environment.

An extensive review of the PD research literature (Kennedy, 2016b[28]) documents how PD programmes in the United States differ in the extent to which they address the five goals of teaching. The review also demonstrated how they varied in degree of autonomy and independent professional judgement they offer to teachers ranging from OTL *prescriptions* (programmes explicitly describe or demonstrate what they believe is the best way for teachers to address a particular teaching problem), *strategies* (prescriptions but accompanied with rationales leading to understanding), *insights* (programmes that push teachers to reflect on practice, to change the way they interpret classroom situations and to make their own decisions about how to respond) and *coherent bodies of knowledge*, that is programmes that provide teachers with concepts and principles, giving teachers 'maximum discretion regarding whether or how teachers [use] that knowledge' (p. 956[28]). Inquiry-based teaching would seem to require the latter and this knowledge is typically acquired in the university. When referring to PD, however, Kennedy notes that early career and experienced teachers are more likely to benefit from strategies and insights as they have presumably absorbed bodies of knowledge in their pre-service preparation.

Another effective approach to PD relies on the development of professional learning communities in schools. An example is the so-called 'Quality Teaching Rounds' as implemented in parts of Australia (Gore et al., 2017[14]) (see Box 6.3 for a short description).

Box 6.3. Quality Teaching Rounds centred on three dimensions of pedagogy to achieve instructional goals

The Quality Teaching Rounds use a lesson study approach (Lewis, Perry and Murata, 2006[29]) backed up by standards of teaching quality specifically those issued by New South Wales. This PD approach 'involves four or more teachers within a school working in professional learning communities'. A round is composed of three sequential sessions that occur in a single day (pp. 99-101[14]):

- *Reading discussion*: Designed to support the group in developing a shared theoretical basis for professional conversations and build a sense of professional community (lasting typically 1 hour).
- *Observation*: One member of the professional learning community teaches a lesson that is observed by all other members of the community (a full lesson length, typically 30-80 min).
- *Coding and discussion*: Individual coding of the observed lesson, including coding by the observed teacher, is followed by discussion whereby all community members contribute (lasting typically one to 2 hours). Coding and discussion are centred on constructs of the Quality Teaching Framework (NSW Department of Education and Training, 2003[30]).

According to the authors, the Quality Teaching Framework focuses teachers' attention on three dimensions of pedagogy centred on instructional goals for students:

1. pedagogy that promotes high levels of intellectual quality (deep knowledge and understanding, problematic knowledge, higher-order thinking, metalanguage, substantive communication)
2. pedagogy that establishes a high-quality learning environment (explicit quality criteria, engagement, high expectations, social support, students' self-regulation, student direction)
3. pedagogy that generates significance by connecting students with the intellectual demands of their work (background knowledge, cultural knowledge, knowledge integration, inclusivity, connectedness and narrative).

Source: (Gore et al., 2017[14])

The Quality Teaching Rounds is an approach to teacher professional development designed to enable conversations around teaching practice that, in the words of Kennedy, may generate strategies and even insights that lead to improvement (2016b[28]). The substance of the discussion evolves around pedagogical practice (using the Quality Teaching Framework), the processes that lead to fruitful discussions (by building a safe space for critical analysis of teaching practice) and continuing improvement of practice (Gore et al., 2017[14]).

Empirical profiling of teachers' opportunities to learn about general pedagogy

Example items for profiling opportunities to learn in initial teacher education

This section contains a description of the TEDS-M OTL indicators (scales) and the items that formed these indicators, as well as the question, prompts[1] (Tatto, 2013[15]). These together successfully provide a profile of ITE and the practicum along the lines suggested in the previous section.

Typically, courses in teacher education programmes in universities offer future teachers OTL on the so-called *foundations*. In TEDS-M, two scales served to measure the extent to which programmes cover such topics. The question prompt read: 'Consider the following topics in education and pedagogy. Please indicate whether you have studied each topic as part of your current teacher preparation program'. The following scales were administered using a binary response format ('studied'/'non-studied'):

a) The *social science* scale included items measuring topics such as 'history of education and educational systems, philosophy of education and sociology of education'.

b) The *applied theory* scale included items measuring 'educational psychology, methods of educational research, assessment and measurement, and knowledge of teaching'.

Another area of interest had to do with the development of *lesson plans, instruction and use of assessments*. These are considered essential GPK skills and are also areas in which future teachers and early career teachers struggle (Abrams, Varier and Jackson, 2016[31]; Datnow and Hubbard, 2016[32]). In TEDS-M, several scales served to measure the extent to which programmes provide OTL in such topics. Future teachers were asked to answer the following prompt: 'In your current teacher preparation program, how frequently did you engage in activities that gave you the opportunity to learn how to do the following?' Responses to the following scales were provided on 4-point Likert scales ranging from ''never'' to ''often'':

c) *Instructional planning*, which included items such as 'accommodate a wide range of abilities in each lesson, create learning experiences that make the central concepts of subject matter meaningful to pupils and create projects that motivate all pupils to participate'.

d) *Instructional practice,* composed of such items as 'learn how to explore multiple solutions and strategies with pupils, learn how to show why rules and procedures work and make distinctions between procedural and conceptual knowledge when teaching concepts to pupils'.

e) *Assessment uses*, which included items such as 'give useful and timely feedback to pupils about their learning, help pupils learn how to assess their own learning and use assessment to give effective feedback to parents or guardians'.

f) *Assessment practice* used items such as 'analyse pupil assessment data to learn how to assess more effectively, assess higher-level goals (e.g. problem-solving, critical thinking) and build on pupils' existing knowledge and thinking skills'.

A key emphasis on teacher education has to do with how well programmes prepare teachers to attend to the learning and emotional needs of *diverse students*. One additional scale was created to measure these aspects:

g) *Teaching for diversity*, which included items such as 'develop specific strategies and curriculum for teaching pupils with learning disabilities, develop specific strategies and curriculum for teaching gifted pupils and develop specific strategies and curriculum for teaching pupils from diverse cultural backgrounds'.

Additionally, it would be important for TALIS to go beyond OTL GPK and to inquire whether teachers from different subjects were given the OTL the 'signature pedagogy on their subject' (see Box 6.4 for respective items for future maths teachers used in TEDS-M).

Box 6.4. Measuring teachers' opportunities to learn the signature pedagogy of their subject

In TEDS-M three scales were developed asking teachers to indicate how frequently they did any of the following in the subject and subject pedagogy methods courses (here mathematics) that they had taken or were currently taking in their teacher preparation program:

h) The *class participation* scale included items such as 'ask questions during class time, participate in a whole-class discussion and teach a class session using methods demonstrated by the instructor'.

i) The *class readings* scale was composed of items such as 'read about research on the subject (in this case mathematics), read about research on teaching and learning mathematics or analyse examples of teaching mathematics (e.g. film, video or transcript of the lesson)'.

j) The *solving problems* scale used items such as 'solve problems in applied mathematics, solve a given mathematics problem using multiple strategies and use computers or calculators to solve mathematics problems'.

While the last two items ('i' and 'j') concern mathematics, the message here is in the identification of a 'signature pedagogy' for the subject in question. In mathematics, the signature pedagogy is the conceptual understanding, mathematical reasoning, solution, and proof of mathematical problems. In science, the signature pedagogy could be using experiments to test hypothesis and build theory. Items can be created similarly for the other subjects taught by teachers participating in TALIS.

Example items for profiling opportunities to learn in the practicum

The quality of the practicum is an essential component of learning to teach. Its success depends on the degree to which future teachers have the opportunity to make (or find) connections between what they have learned in their courses and the practical tasks of teaching (e.g. to facilitate practical theorising). An important factor is the close collaboration of the supervising teacher or mentor with the university instructors, and the quality of the feedback the supervising teacher or mentor provides to future teachers. Three scales measured these important aspects of practice-based learning of future teachers (Tatto, 2013[15]):

a) *Connecting classroom learning to practice* asked future teachers 'During the school experience part of your program, how often were you required to do each of the following? Answers were provided on 4-point Likert scales (ranging from ''never'' to ''often''). Future teachers rated, for instance, how often they were 'asked to demonstrate that they could apply the teaching methods they were learning in their courses', and 'how often they had the opportunity to test out findings from educational research about difficulties pupils have in learning in their courses'.

b) Two scales asked specifically about experiences with their supervising or mentor teacher: 'To what extent do you agree or disagree with the following statements about the teaching practicum you had in your teacher preparation program?' Respondents provided answers on 4-point Likert scales (ranging from 'disagree' to 'agree') to the following scales and items:

   1. *Supervising teacher reinforcement of university goals for the practicum* asked, for instance, whether future teachers had a 'clear understanding of what their school-based supervising teachers or mentors expected of them as a teacher to pass the practicum,' whether they 'learned the same criteria or standards for good teaching in their courses and their practicum,' and whether their 'school-based supervising teachers or mentors used criteria or standards provided by their university or college when reviewing their lessons with them'.
   2. *Supervising teacher feedback quality* asked, for example, whether the 'feedback future teachers received from their supervising teacher or mentor helped them to improve their understanding of pupils', their 'teaching methods' and their 'understanding of the curriculum'.

These examples of OTL ITE scales have gone through much revision and scrutiny to develop a high quality instrument within a defensible theoretical framework to profile ITE course and practicum experiences across a diverse set of countries in the TEDS-M study. They could be used as a starting point for refining existing indicators on mentoring, teacher feedback and development and practical (field) experiences for the next TALIS cycle (Ainley and Carstens, 2018[17]).

Example items for profiling opportunities to learn in teacher induction

Several of the scales described in the previous sections, and particularly the teaching practicum items, can also be asked of the induction period. OTL in induction, however, needs to be tailored to each individual's experience and carefully illustrated in the recent observational study comparing the experiences of interns and early career teachers in England and the United States (Tatto et al., 2018[7]). As this in-depth study revealed, unique opportunities for early development are present when enacting practise emerging from contradictions between what teachers expect to happen as a result of planning and what occurs in the classroom, or as school norms begin to challenge teachers' autonomy to address the needs of their students.

Opportunities for change and to improve practice occur if these contradictions are met by effective mediational tools offered by the ITE institution or the school. These may include theoretical frameworks, short or long terms planning formats or the specific feedback or advice of a university-based or school-based instructor or mentor. Key in this dynamic, are the *individual's mediational tools* such as prior experience, knowledge and sense-making of the subject and processes of reflection underlying a sense of agency to inform future practice. Learning to teach across ITE, the induction period and PD is highly dependent on the individuals' disposition to recognise the opportunities for development and the opportunities for change that are both provided to them or that occur as a result of everyday practice.

While the LTTE-US study (Tatto et al., 2018[7]) did not develop scales it is possible to imagine the construction of items that could lead to scales to measure what are the most conducive opportunities for development for early career teachers, and what mediational tools at the institutional and individual levels are more supportive in producing a change in teaching practices. Equally important is to measure the individuals' disposition to recognise these opportunities for development and change and thus, teachers' beliefs play a key role across the continuum of teacher learning and especially in the crucial induction period because as it is known, many early career teachers leave the profession within the first five years. The emergence of contradictions can in part be explained by the lack of alignment between the individual intentions and beliefs and the higher education institution (HEI) and school culture and norms (Tatto et al., 2018, pp. 49-50[7]).

The TEDS-M study did develop a scale to measure such a sense of alignment (Tatto, 2013[15]). Teachers were asked to 'consider all of the courses in the programme including subject matter courses, subject pedagogy courses as well as general education and pedagogy courses. They were then asked to indicate the extent to which they agree or disagree with a series of statements on 4-point Likert scales.

The *programme coherence* scale included statements such as:

- Each stage of the programme seemed to be planned to meet the main needs teachers had at that stage of their preparation.
- Later courses in the programme built on what was taught in earlier courses in the program.
- The programme was organised in a way that covered what they needed to learn to become an effective teacher.
- The courses seemed to follow a logical sequence of development in terms of content and topics, each of their courses was designed to prepare them to meet a common set of explicit standard expectations for beginning teachers.
- There were clear links between most of the courses in the teacher education programme and school practices.

The FIRSTMATH study complements the induction profile that TEDS-M began to explore. FIRSTMATH inquired about OTL and beliefs in teachers' early career period.

Learning how to reflect on practise and using these reflections to improve it are essential skills needed for successful teaching, as revealed in the LTTE-US study. Two FIRSTMATH scales measured whether early career teachers had OTL this ability. The prompt asked teachers 'Please indicate whether you have ever had the opportunity to learn how to do each activity and whether you currently have the opportunity to do each activity in your classroom?' (Tatto et al., 2020[16]). The scales used binary response formats ('learned' vs. 'not learned' and 'yes I do this' vs. 'No, I do not do this'). The following two scales were administered:

a) The *teaching for reflection on practice* scale includes items asking whether future teachers had the 'OTL to use teaching standards and codes of conduct to reflect on their teaching', 'develop strategies to reflect upon the effectiveness of their teaching' and 'develop strategies to reflect upon their professional knowledge'.

b) The *improving practice* scale is composed of items such as 'develop and test new teaching practices', 'learn how to use findings from research to improve knowledge and practice' and 'identify opportunities for changing existing schooling practices'.

- An additional scale asked early carer teachers about their access to mediational tools and resources, a key element to successful development found in the LTTE-US study (Tatto et al., 2018[7]):

c) The *mediational tools/resources* scale asked teachers to indicate how important if at all, is each resource in their learning to teach. Items were, for instance, 'resources from their teacher preparation program', their 'professor(s) in their teacher preparation programme' and their 'mentor teacher in their current school' as well as their 'own resources'.

These OTL scales, measuring the different and complex dimensions of OTL in the induction period, have gone through a thorough validation and revision process in both the TEDS-M and FIRSTMATH studies, leading to the development of a high quality instrument to profile OTL in the induction period in teachers' early years on the job. These example items present valuable options for expanding on teachers' OTL in induction in future cycles of TALIS.

Example items for profiling opportunities to learn in professional development

While practically many of the scales listed for profiling OTL in initial teacher education and induction can be used to measure OTL in PD, there are unique characteristics of PD that would require specialised questions. Two examples are taken from the FIRSTMATH study (Tatto et al., 2020[16]):

1. The *OTL professional development* scale asked teachers to indicate how much emphasis if any, their professional development activities placed on each topic during the last 12 months. Items that teachers rated (ranging from none to great on a 4-point Likert scale) were, for example, 'improving students' critical thinking or problem-solving skills', 'teaching children from disadvantaged backgrounds' or 'gifted children', 'classroom management' and 'how to communicate and work with parents'.
2. *School context conducive to PD* scale measured how often, if ever, teachers had different types of interaction with other teachers. Teachers rated how often the following types of interactions happened (ranging from daily to never on a 4-point Likert scale): 'discussions about planning for lessons or teaching a particular concept', 'working on preparing instructional material' or 'visits to other teachers' classroom to observe their teaching'.

The Kennedy (2016b[28]) and Gore (2017[14]) studies, as well as FIRSTMATH (Tatto et al., 2020[16]), provide valuable insights for measuring different dimensions of OTL in PD. TALIS 2018 attempts to cover these aspects by asking teachers if a list of 'core practices' was covered in their PD or whether they received evaluative feedback from administrators or evaluators. Instead, it would be important to measure whether PD is more conducive to helping teachers learn strategies and develop insights and gain increased knowledge. It is vital to understand how to develop the capacity among teachers and schools to create safe spaces where teachers can learn to examine and be critical about their practice in a way that is conducive to professional learning and the development of learning communities.

Conclusion

Overall, the TALIS 2018 teacher questionnaire asked useful questions and provided valuable information for participating countries on how to improve the preparation and professional development of teachers. The 2018 TALIS questionnaire had a heavy emphasis on professional development thus a more uniform balance across the four areas of ITE, practicum, induction and PD would be recommendable for future cycles.

Further items sensitive enough to measure the diverse profiles of OTL in ITE, practicum, induction, and PD across countries would help guide policies directed at improving teacher education and learning. This is important because it is doubtful that PD alone can help teachers learn in a short period what teachers did not learn during ITE or in 'fast-track' programmes. TEDS-M and FIRSTMATH and the insights from the several studies included in this chapter could be used as a starting point for expanding TALIS to further the scientific and policy-relevant knowledge about teachers across countries. Table 6.2 below provides other ideas on how to expand and refine the TALIS 2018 questionnaire for the TKS assessment module to allow for more nuanced profiling of teachers' OTL as they progress on their professional careers (see Table 8.1 in Chapter 8 for the main takeaways from this chapter for TALIS and the TKS assessment module).

Table 6.2. Suggestions for expanding and refining the TALIS 2018 questionnaire on teachers' Opportunities To Learn (OTL) in their professional career for future cycles

TALIS 2018 Teacher questionnaire (TQ)	Comment	Recommendations
Initial Teacher Education (ITE) OTL		
TQ-06. Were the following elements included in your formal education or training and to what extent did you feel prepared for each element in your teaching? *Items: 'General pedagogy' and other elements*.	Several of the items are formulated in a rather broad and vague style, including the ones of most interest for the TKS assessment module: 'general pedagogy,' 'classroom practice,' 'monitoring students' development and learning,' and 'facilitating transitions'.	To have a more nuanced profiling of ITE OTL for the TKS assessment module the items need to include a more detailed description of what is understood by each term. Additionally, elements of a syllabus analysis similar to the one done in TEDS-M could guide the development of additional items for the module. Special attention should be given to the importance for these OTL to be authentically grounded in ITE practices.
TQ-15. Were the following subject categories included in your formal education or training, and do you teach them during the current school year to any ISCED-2 Level or 15-year-old students in this school? *Items: 'Mathematics' and other subjects*.	The question allows a report of whether teachers have had the OTL the content of the subjects, while it does not provide information if the methods of instruction in each subject area (pedagogical content knowledge) were covered.	The response option 'Included in my formal education or training' could be modified to ask if teachers had the OTL subject-specific-teaching methods as well: 'Content included in my formal education or training' and 'Methods included in my formal education or training'.
Induction OTL		
TQ-20. When you began work at this school, were the following provisions part of your induction? *Items: 'Online courses/seminars' and other provisions.*	Key aspects are missing which are very relevant, especially during teachers' early career. Items for the question could be added to provide further information on mentoring, feedback and observation and collaboration to what was already covered in TALIS.	The following two items could be added: 'Mentoring from an experienced teacher' and 'Peer observation, discussion and feedback'. Further items can be derived from the FIRSTMATH items described above.
TQ-21. Are you currently involved in any mentoring activities as part of a formal arrangement at this school? *Items: 'I currently have an assigned mentor to support me.' and 'I am currently an assigned mentor for one or more teachers*.'	Though having an assigned mentor, teachers are not always interacting with them. This may be one of the reasons why teachers quit teaching in the first five years of teaching. Moreover, it is commonly assumed that teachers already know how to mentor but research shows that mentoring is a learned skill. It would, thus, be important to know whether teachers have received courses on mentoring.	The following items could be added: 'I have daily discussions about my teaching with my school mentor', and 'I have had OTL how to mentor early career teachers or teachers new to the school.' Additionally, a question should be added that asks teachers to quantify and qualify the mentoring received and provided. These and further items on teacher induction can be developed drawing on experiences from the FIRSTMATH and LTTE-US studies described above.
Professional Development (PD) OTL		
TQ-23. Were any of the topics listed below included in your professional development activities during the last 12 months? *Items: 'Student assessment practices' and other topics.* **TQ-27.** For each of the areas listed below, please indicate the extent to which you currently need professional development. *Items: 'Student assessment practices' and other areas.*	It would be possible to ask teachers both questions in one question to reduce the survey burden. The topics and areas listed for both questions could also be more aligned.	Merge both questions and response options in the following way: 'In your professional development activities did you have the opportunity to learn the following topics during the last 12 months and indicate the extent to which you currently need professional development. Two binary response options (Yes/No) could be provided to answer the two elements of the question separately: 'I had the opportunity to learn this topic' and 'I currently need professional development in the area'.

TALIS 2018 Teacher questionnaire (TQ)	Comment	Recommendations
TQ-26. Thinking of the professional development activity that had the greatest positive impact on your teaching during the last 12 months, did it have any of the following characteristics? *Items: 'It built on my prior knowledge' and other characteristics.*	The question could be refined to capture the level of autonomy and professional judgement that the PD activities allowed teachers.	Revise this question to capture the PD characteristics outlined by Kennedy (2016b[28]): prescription, strategies, insight, bodies of knowledge. Further valuable item suggestions can be derived from the FIRSTMATH study described above.
TQ-28. How strongly do you agree or disagree that the following present barriers to your participation in professional development? *Items: 'Professional development is too expensive' and other potential barriers*.	The question does not consider that a lack of benefits derived from PD participation may cause teachers to disengage.	The following items could be added to capture a lack of benefits derived from PD participation: 'Low learning gains for time invested' and 'Professional development does not help build a professional learning community in the school'. .
TQ-29. In this school, who uses the following types of information to provide feedback to you? *Items: 'Observation of my classroom teaching' and other types of information*.	This question asks whom gives feedback on specific activities. Thus, the question allows information on the type of feedback but not on its content.	Questions could be added to ask if teachers received feedback on planning, instruction, assessment and teaching for diversity. These are areas where teachers most struggle. For instance the following item relating to diversity could be added: 'Feedback on the latest strategies to address the learning needs of students with special needs and from multicultural backgrounds.' Further ideas can be derived from the FIRSTMATH study described above.
TQ-31. Thinking about the feedback you have received during the last 12 months, did it lead to a positive change in any of the following aspects of your teaching? *Items: 'Classroom management' and other aspects of teaching*.	The questions could be framed more specifically and expanded to include items that ask about planning or the curriculum (since PD is the main tool used by governments to implement curricular reforms).	The question could be changed from 'positive change' to 'an improvement in teaching practice and pupil learning.' The following items could be added: 'Planning for critical thinking and conceptual understanding' and 'A deeper knowledge of the curriculum'.
TQ-33. On average, how often do you do the following in this school? *Items: 'Teach jointly as a team in the same class' and other collaborative activities*.	This is a good proxy for conducive collaborative and dynamic OTL for teachers in schools, which could be expanded further. The frequency of occurrence can indicate the level of schools' professional learning communities and the formation/support for the notion of distributed leadership. Important aspects are missing such as curriculum.	The following two items could be added: 'Read each other's lesson plans and provide suggestions for improvement' and 'Work with other teachers to understand and implement curricular changes'. Further ideas can be derived from the FIRSTMATH study described above.
General Comment		
TQ-06, TQ-15 and **TQ-23**. General comment	The questions ask teachers if a list of topics 'were included in their formal education.' Inclusion, however, does not mean that teachers learned or engaged at all or in a meaningful way with these elements.	These questions should be rephrased as: 'In your <formal education or training>, <professional development activities> did you have the opportunity to learn the following topics…'

Further recommendations for research on teachers' professional learning

Arriving at common definitions and measures of opportunities to learn

The conceptualisation of GPK needs to be aligned with the conceptualisation of OTL GPK. Excellent teachers need a substantial dose of academic studies (academic studies in disciplines such as psychology and sociology), as well as on the subjects they will teach (such as literature, mathematics, science and others aligned with the school curriculum). Additionally, they need foundational studies as applied to teaching (e.g. philosophy of education and ethics) and they need to learn theory as it applies to practice. The TEDS-M syllabus analysis helps to understand the configuration of OTL across 17 countries (Tatto, 2013[15]). More work is needed to figure out how different OTL contribute to different aspects of teaching. It is also important to distinguish between the knowledge needs of future, early career and more

established teachers. Future teachers may benefit from OTL that emerge from 'bodies of knowledge', strategies and insights, while early career teachers and more established teachers may benefit from OTL that offer them strategies and insights and even from prescriptions as well as learning from a professional community of practice (further explained in Box 6.3).

Longitudinal research that links teacher education, teacher knowledge and skills, teaching and learning

After defining the contours of the OTL domains to be conceptually linked to the different stages in the developmental process of becoming a teacher, a programme of longitudinal research is needed. Rigorous longitudinal research must seek to link evidence from the GPK assessment measuring teachers' knowledge at different stages of their careers, and these with GPK OTL. A longitudinal programme of research will allow the field to build a better research evidence base for the profession.

Addressing teaching and learning to teach holistically

An important concern for teachers is how to portray and enact the curriculum to students. Planning, instruction and evaluation occur around the particular school subjects' pupils need to learn (Tatto et al., 2018[7]). TEDS-M demonstrated that the most knowledgeable future math teachers were from programmes that provided balanced OTL content knowledge, pedagogical content knowledge and GPK together.

The current pandemic is placing increasing pressure on ITE programmes and PD to emphasise GPK in such aspects as socio-emotional learning and the use of online technologies, among others. This should not be done at the expense of preparing highly knowledgeable teachers in their subjects, able to help all students make sense of the curriculum, and able to structure successful and conducive learning environments. The measurement of GPK should be complemented in the future by a measure that integrates the OTL content and pedagogy as expressed in the concept of *pedagogical content knowledge*. This would allow, for instance, to better understand how teachers' planning is linked to the essential content and content pedagogy that teachers must possess to teach effectively.

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Note

[1] Results from the confirmatory factor analysis are available in the TEDS-M Technical Report (Tatto, 2013[15]).