

Unclassified

EDU/CERI/CD/RD(2017)4

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

31-Mar-2017

English - Or. English

DIRECTORATE FOR EDUCATION AND SKILLS
CENTRE FOR EDUCATIONAL RESEARCH AND INNOVATION (CERI) GOVERNING BOARD

Cancels & replaces the same document of 30 March 2017

INNOVATIVE TEACHER FOR EFFECTIVE LEARNING (ITEL)

Preliminary findings of the ITEL Teacher Knowledge Survey

4-5 April 2017

This paper accompanies the Governing Board doc [EDU/CERI/CD(2017)2] on the progress of CERI's Teacher Knowledge Survey – Pilot Study, within the Innovative Teaching for Effective Learning (ITEL-project). It complements the main document by providing an extension on the validation of GPK instruments and results.

For further information please contact:

Tracey Burns, Senior Analyst, EDU/IMEP, Tracey.burns@oecd.org

Kristina Sonmark, Consultant, EDU/IMEP, Kristina.sonmark@oecd.org

JT03411750

Complete document available on OLIS in its original format

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.



EDU/CERI/CD/RD(2017)4
Unclassified

English - Or. English

TABLE OF CONTENTS

INNOVATIVE TEACHING FOR EFFECTIVE LEARNING: PRELIMINARY FINDINGS OF THE
TEACHER KNOWLEDGE SURVEY PILOT3

Introduction.....3

Validation results of the GPK assessment framework.....3

 Group 1 items:.....4

 Group 2 items:.....4

 Group 3 items:.....5

Pedagogical Knowledge.....6

 Models of teacher’s pedagogical profiles.....6

 Overview:16

Opportunities to learn and knowledge dynamics17

 Content of opportunities to learn and its relation to knowledge17

 Teaching diverse classrooms.....18

 Relationship to pedagogical knowledge.....19

 Teaching practicum21

 Quality of opportunities to learn22

Knowledge dynamics in the profession24

 Engagement in and with Research24

 Professional collaboration25

 Relationship between collaboration and engagement in/with research.....27

Motivation.....28

 Self-efficacy29

 Motivations for teaching30

 Self-responsibility31

 Motivation to persist in the profession33

 Relationships between motivation and In-service Instructional Quality.....34

REFERENCES36

ANNEX38

INNOVATIVE TEACHING FOR EFFECTIVE LEARNING: PRELIMINARY FINDINGS OF THE TEACHER KNOWLEDGE SURVEY PILOT

Introduction

1. This paper accompanies the Governing Board doc [[EDU/CERI/CD\(2017\)2](#)] on the progress of CERI's Teacher Knowledge Survey – Pilot Study, within the Innovative Teaching for Effective Learning (ITEL–project). It complements the main document by providing an extension on the validation of GPK instruments and results. For consistency in narrative a few tables reoccur, these are marked with a reference to the main Governing Board document.

Validation results of the GPK assessment framework

2. The theoretical validation generated 52 items for the data collection of the Pilot Study. These items were empirically validated through IRT scaling 1PL (Rasch 1960, DeMars 2010). Cronbach's Alpha test of scale reliability was also conducted on the pooled sample as well as by country. In the current phase, IRT scaling was carried out in the In-Service and Pre-Service teachers' candidate samples. Teacher Educators were the group with the lowest response rate and did not reach the minimum sample size required for a 1 parameter IRT model.

3. The validation of the instrument generated three clusters of GPK items. A first, and largest, group consist of items where the IRT scaling resulted in differentiation in item difficulty and a similar pattern across countries. These items are ready to be taken further to the next step phase of the work, the Main Study. The second group showed less convincing differentiation in difficulty as well as inconsistency across countries and will need further refinement before they can be incorporated in the study design. A third, small group of items had to be excluded from the IRT scaling due to no variation in one or several of the five countries (all responded correct or all incorrect). Examples of each of these are given below.

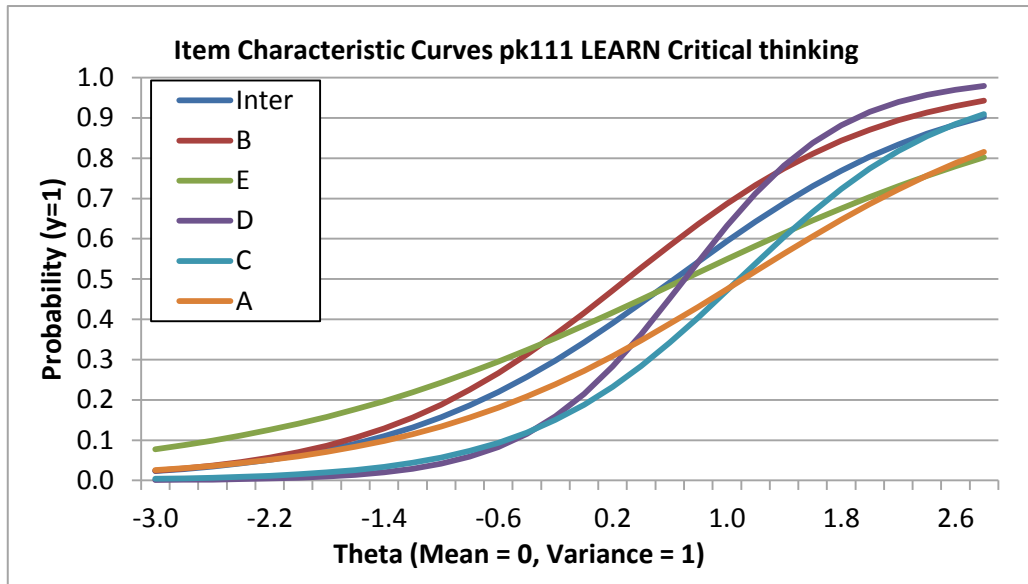
4. The two latter item clusters will be analysed further with regard to the questions and their content. There may for example be bias due to translation and verification as well as terminology that needs further improvement to suit an international comparison. All items developed for the Pilot Study will be kept but taken further in various steps examples from the three groups are illustrated below.

5. 1 parameter IRT models describe, in probabilistic terms, the strength of the relationship between an individual's response to a survey question and the level of a latent variable (theta θ) being measured by the scale. In this context it refers to the probability of answering an item correctly given a latent trait of proficiency. Another area where IRT models are applied is public health and medical statistics, for example in measuring the probability of reporting somatic symptoms given a latent trait of depression. The objective is to model each item by estimating the properties describing its performance and the parameter indicates how well an item discriminates between respondents below and above the item threshold, here between high and low ability. This relationship is illustrated through an Item Characteristic Curve [ICC].

6. Figure 1 shows an ICC from the first group on the topic *key demands for the 21 century* within the learning process dimension (see assessment framework figure 4) from a one parameter logistic (1PL) model, illustrating how well the item differentiate between high- and low ability teachers. Theta (X-axis) represents the latent ability in standardized values, b is the estimated difficulty coefficient and P (Y-axis) is the probability of solving a given item at the different points of the proficiency scale.

Group 1 items:

Figure 1. Example of GPK item of 21 century demands: successful differentiation

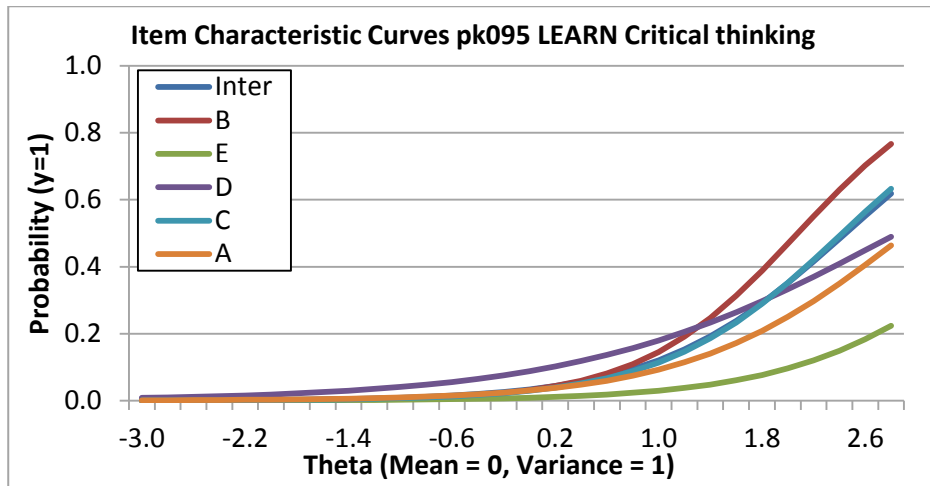


7. The slope of the ICC (how steep it is) indicates whether only the most skilled teachers are able to answer a difficult item correctly. At the lower end of the proficiency scale the probability of answering the items correctly is low and along the x-axis, the probability increases. When an item differentiates well, it is answered correctly only by the highest-ability teachers, and this forms the s-shape of the curve (the relationship is most often non-linear). Figure 1 is an example from the first group that differentiates well in terms of item difficulty. Low ability teachers have a low probability of answering correctly and high ability teachers have a high probability.

Group 2 items:

8. If an item does not differentiate well, then the ICC will be flat as shown in Figure 2. This item also stems from *21 Century key demands* but it does not differentiate difficulty equally well between low- and high-ability teachers as in Figure 1 above. The flat ICC indicates that the probability of answering the items correctly is consistently low along the proficiency scale. It may be a particularly difficult item, but it can also be the case that the item has been answered correctly by a share of the respondents but those who did respond correctly may not necessarily have been the most knowledgeable teachers: they may for example have guessed and gotten the item correct. Poor differentiation can also be illustrated with a line in the upper end of the ICC graph, indicating that the items was answered correctly by both high and low ability teachers, which also indicates poor differentiation in difficulty.

Figure 2. Example of GPK item of 21 century demands: poor differentiation.

**Group 3 items:**

9. The third small set of items was not included because one or several countries showed no variation (i.e., all responded correctly or all responded incorrectly). If this appeared in one of the five countries, the item had to be excluded for the model to be identified. This was the case for all three samples IST [3 items] PST [3 items] and TE [6 items]. Three items are exemplified from the in-service teacher sample shown in Figure 3. The first lies within the topic of *'key demands for 21st century teaching' on creative thinking* where a very high proportion could solve the item and in two countries all responded correctly. The same pattern is found for a *practice-based* item in the *'core knowledge' category*, whereas *theoretical/scientific* items in *core knowledge* had a larger variation and in one country none of the respondents answered correctly.

Table 1. Example of items in the In-service teacher sample.

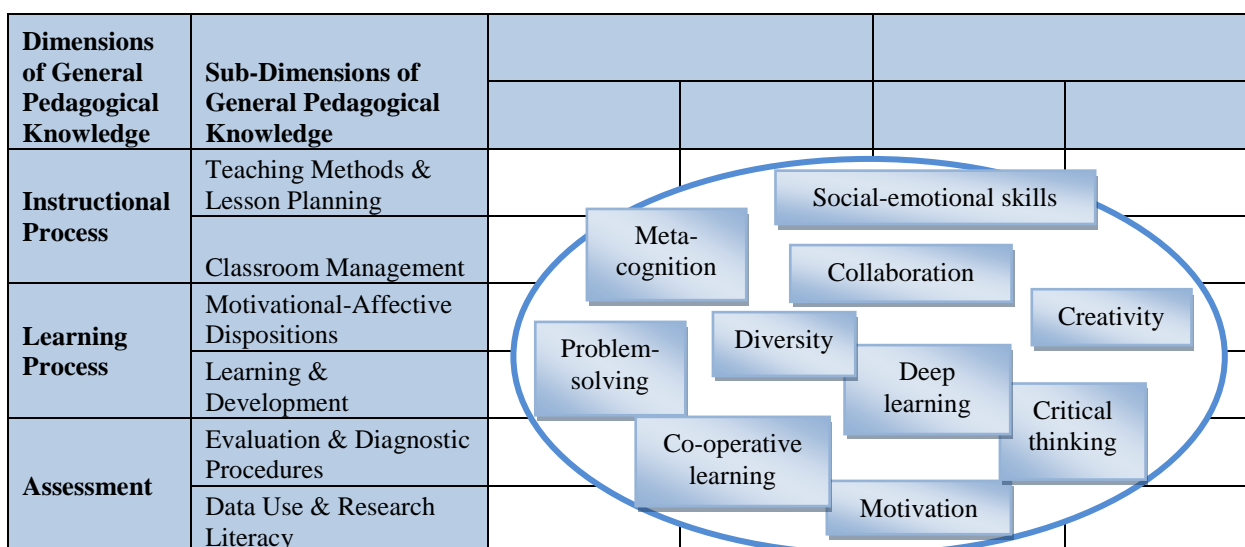
Percentage of respondents answering the item correctly			
Country	Item pk124 <i>21 century demands creative thinking</i>	Item pk039 <i>Core knowledge theoretical/ scientific.</i>	Item pk177 <i>Core knowledge practice- based</i>
A	100	34.92	95.65
B	99.73	21.3	84.97
C	99.12	68.69	77.24
D	99.07	58.11	100
E	100	0	89.77

10. As outlined in [EDU/CERI/CD\(2017\)2](#) the first group of items will be taken directly to the Main Study and can be used as is. The two latter groups will be analysed with regard to their content and needs for refinement, and then further developed by the Secretariat. These items will also be sent to countries participating in the Pilot Study for review within the national context along with the first draft of results (for reporting schedule see [\[EDU/CERI/CD\(2017\)2\]](#)).

Pedagogical Knowledge

11. The profiles of teachers’ pedagogical knowledge were developed based on the Assessment framework of this pilot study ([EDU/CERI/CD\(2016\)3](#)). The framework consists of three broad dimensions with each dimension having two sub-dimensions (see Figure 3). Items cover areas in the circle below and are mapped according to their broad and sub-dimensions as well as these areas. An example may for example be labelled: Learning Process (broad dimension)-Learning and Development (sub-dimension)-Problem-solving (topic).

Figure 3. Assessment Framework General Pedagogical Knowledge



Models of teacher’s pedagogical profiles

12. As outlined in [EDU/CERI/CD\(2017\)2](#) teachers’ knowledge base was tested according to the three broad dimensions of Instruction, Learning and Assessment. We have examined the findings by country and by sample of teacher (i.e. by teacher candidate, teacher and teacher educator), looking for the proportions of participants in each category who answered 60% or more of the questions in each dimension correctly. This gave rise to a set of three types of profiles that capture the strengths and weaknesses of teachers’ pedagogical knowledge. They are:

- Profile 1: Assessment (a higher proportion of respondents scored at least 60% correct item to questions classified as in the assessment dimension). This profile is the most common and has three further variations, outlined below.
- Profile 2: Instructional (a higher proportion of respondents scored at least 60% correct items to questions classified as in the instructional process dimension)

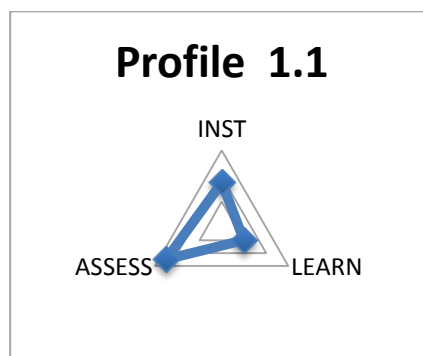
- Profile 3: Balanced (relatively similar proportions of participants scored above 60 in all three dimensions although the Assessment dimension typically still comes out on top).

13. It is apparent that there is no Profile that favours the Learning dimension. This is because across all participating countries and for all sub-samples we did not identify any case where a higher proportion of respondents scored at least 60% correct items on the learning dimension than in the other two dimensions.

Profile 1.1: High Assessment, then tending to favour Instructional over Learning:

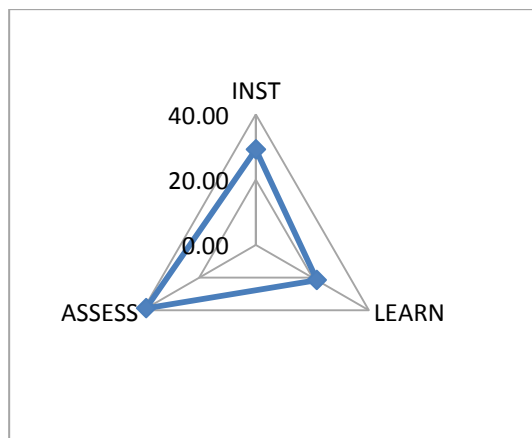
14. This profile (Graph 1) is typically seen in Country D and Country C and also is particularly apparent for in-service and pre-service teachers.

Graph 1. Profile 1.1



15. For example, teachers in Country B exhibit a P1.1 knowledge base, characterised by the highest proportion (38.8%) of respondents scoring 60 or more in the Assessment knowledge items, followed by 29.2% on the Instructional Processes and 21.6% on the learning and development items. Please see Graph 2 below:

Graph 2. Profile: Teachers Country B

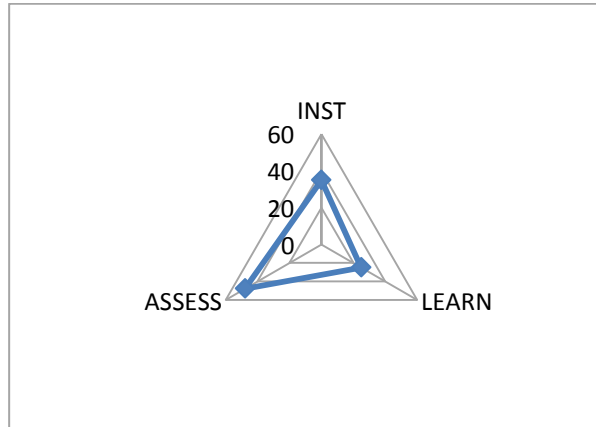


16. However, the overall differences between these different dimensions are not that pronounced and this can be seen from the relatively even triangle in the graph above, with a noticeable but not exaggerated leaning towards the Assessment axis.

17. Teachers in Country D exhibit also a P1.1 knowledge base, characterised by the highest proportion (47.9%) of respondents scoring at least 60% correct items in the Assessment knowledge,

followed by 34.97 % on the instructional processes and 25 % on the learning and development items. Please see Graph 3 below:

Graph 3. Profile: Teachers Country D

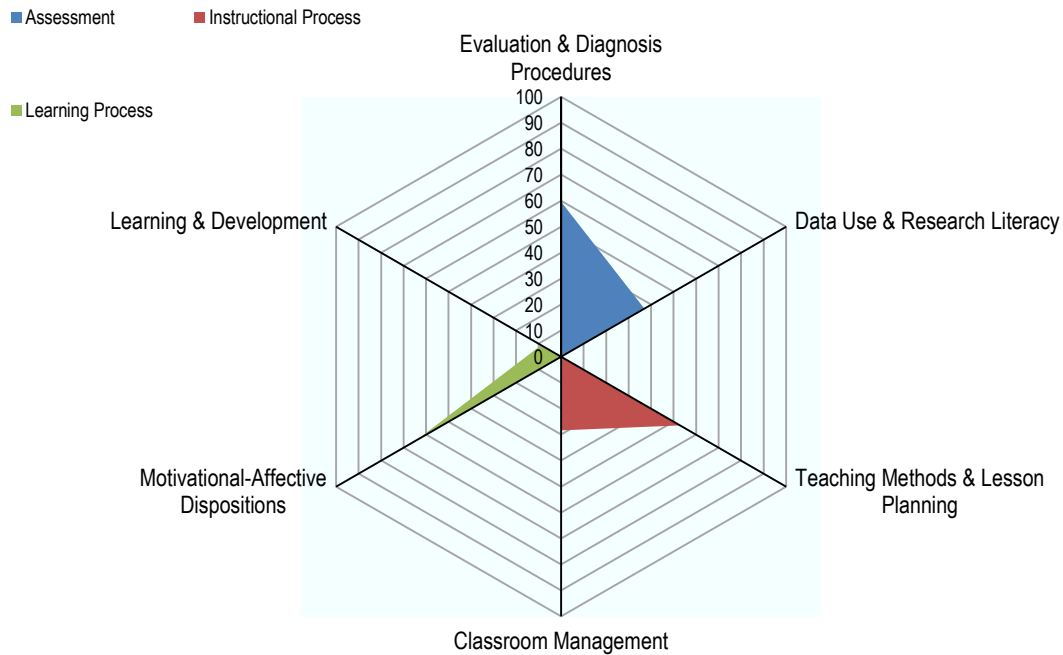


18. For the dimension Instructional Processes 28.38 % of the respondents scored at least 60% correct items in the classroom management items and 52.94 % in the items measuring teaching methods and lesson planning. For this particular dimension, teachers actually perform better than teacher educators, and at the sub-dimensional level, they score better in Teaching Methods and Lesson Planning than either teacher candidates or teacher educators, possibly reflecting the importance of practical experience to this particular sub-dimension.

19. For the dimension Learning Processes 25% of the respondents who scored at least 60% correct items, 63.99% scored at least 60% correct items capturing Motivational and Affective Dispositions sub-dimension but only 8.82% scored at least 60% correct items in the Learning and Development items. As with the other two categories of teachers in Country D, the variance in the number of respondents scoring over 60 in these two sub-dimensions is particularly striking. This can be seen in the extremely narrow green triangle that can be seen below in Graph 4.

20. For the Assessment dimension the fewer respondents (36.99%) scored at least 60% correct items in the Data Use and Research Literacy items than in the Evaluation and Diagnosis procedures items (59.6%). This shows a similar pattern to Teacher Educators.

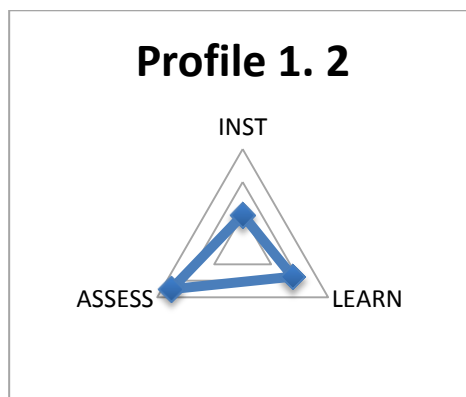
Graph 4. Profile: Teachers Country D. Sub dimensions



Profile 1.2: High Assessment, modest Learning, low Instruction:

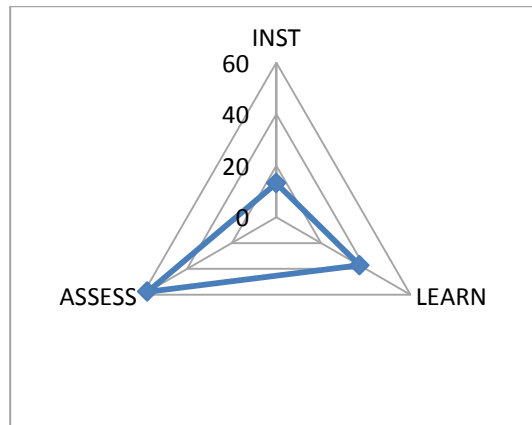
21. Similar to the model above, this profile (Graph 5) has a fairly obvious skew towards the Assessment dimension. However, contrary to Profile 1.1, there is a clearer understanding of learning items while the Instructional dimension is the weakest. This model is more typical in Country A and E.

Graph 5. Profile 1.2



22. Teachers in Country A exhibit the Profile 1.2 model knowledge base, characterised by the highest proportion (57.7 %) of respondents scoring 60 or more in the Assessment knowledge items, followed by 37.25 % on the learning and development items and 13.21 % on the Instructional Processes . This can be seen from a flat triangle that is also skewed fairly heavily to the left in the graph 6 below:

Graph 6. Profile: Teachers in Country A

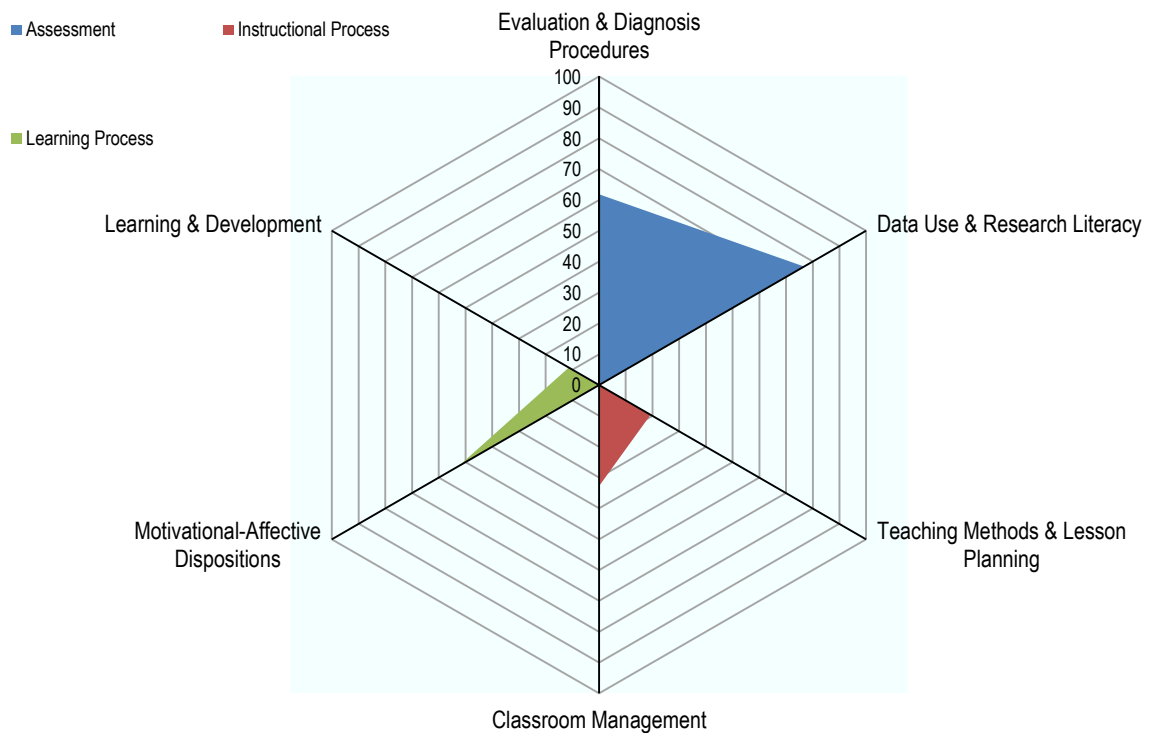


23. Teachers in country A at a sub-dimensional level, specifically in the Instructional Processes items, 32.76 % of the respondents scored at least 60% correct items for the Classroom Management dimension and 19.29 % did so in the Teaching Methods and Lesson Planning items. This can be seen from the slightly spikier red triangle below compared to those of the other two categories (Graph 7).

24. Within the Learning Processes dimension, 52.54% of participants scored at least 60% correct items in the capturing Motivational and Affective Dispositions sub-items but just 11.32% did so in the Learning and Development items.

25. For the Assessment dimension, Assessment the majority of respondents (76.78%) scored at least 60% correct items in the Data Use and Research Literacy sub dimension while 61.82 % scored at least 60% correct items in the Evaluation and Diagnosis Procedures items.

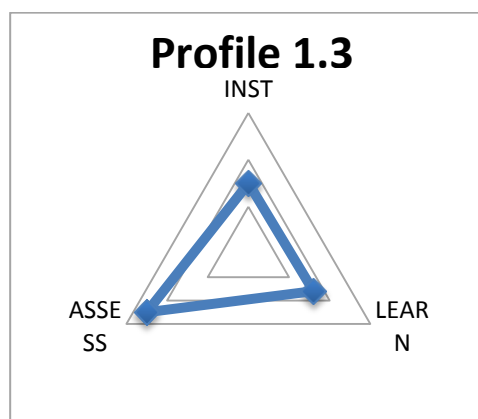
Graph 7. Profile: Teachers in Country A Sub-dimensions



Profile 1.3: High Assessment. Balanced Learning and Instruction:

26. In this profile (Graph 8) the Assessment items (as seen from the proportion of respondents who responded at least 60% correct items) are favoured but the percentage of respondents scoring over 60% correct for the Learning and Instructional items is similar. This profile is only seen in teacher candidates in Country A and Country E.

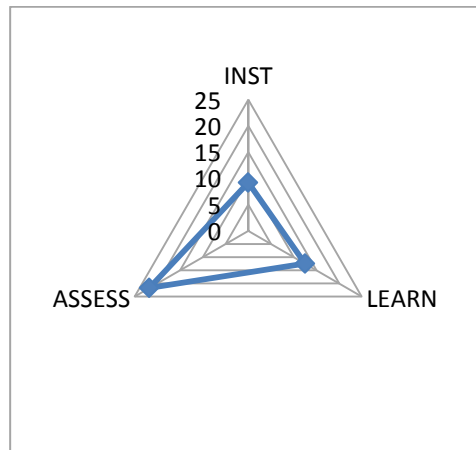
Graph 8. Profile 1.3



27. Teacher candidates in Country E exhibit an Assessment model knowledge base (Profile 1.3), with a much more even distribution between the Learning and Instructional dimensions. It is characterised by the highest proportion (22%) of respondents scoring 60 or more in the Assessment knowledge items,

followed by just 13% on the Learning items and just 9% on the Instructional Processes items. Please see Graph 9:

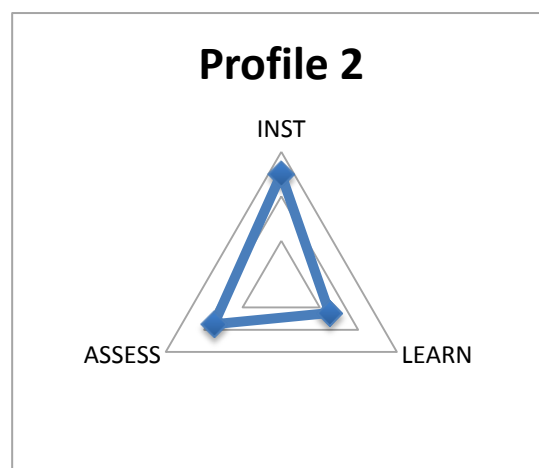
Graph 9. Profile: Teacher candidates in Country E



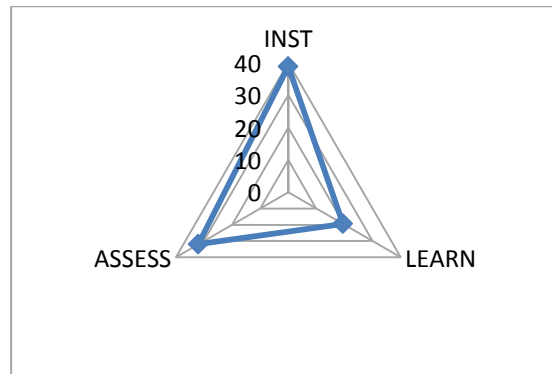
Profile 2: Instructional process:

28. While this model continues to exhibit a relatively high proportion of respondents who responded at least 60% correct items in the Assessment dimension, it is characterised by an even higher proportion of such proportions in the Instructional dimension. The Learning dimension has the lowest proportion of respondents who responded at least 60% correct items. This model (Graph 10) is only seen among teacher educators in Country C and teacher candidates in Country B.

Graph 10. Profile 2



29. Teacher candidates in Country B exhibit an Instructional knowledge base, characterised by the highest proportion (38.8%) of respondents scoring 60% or more correct items in the Instruction knowledge items, followed by 31.9% on the Assessment processes and 19.5% on the Learning and Development items. Please see Graph 11.

Graph 11. Profile: Teacher candidates in Country B

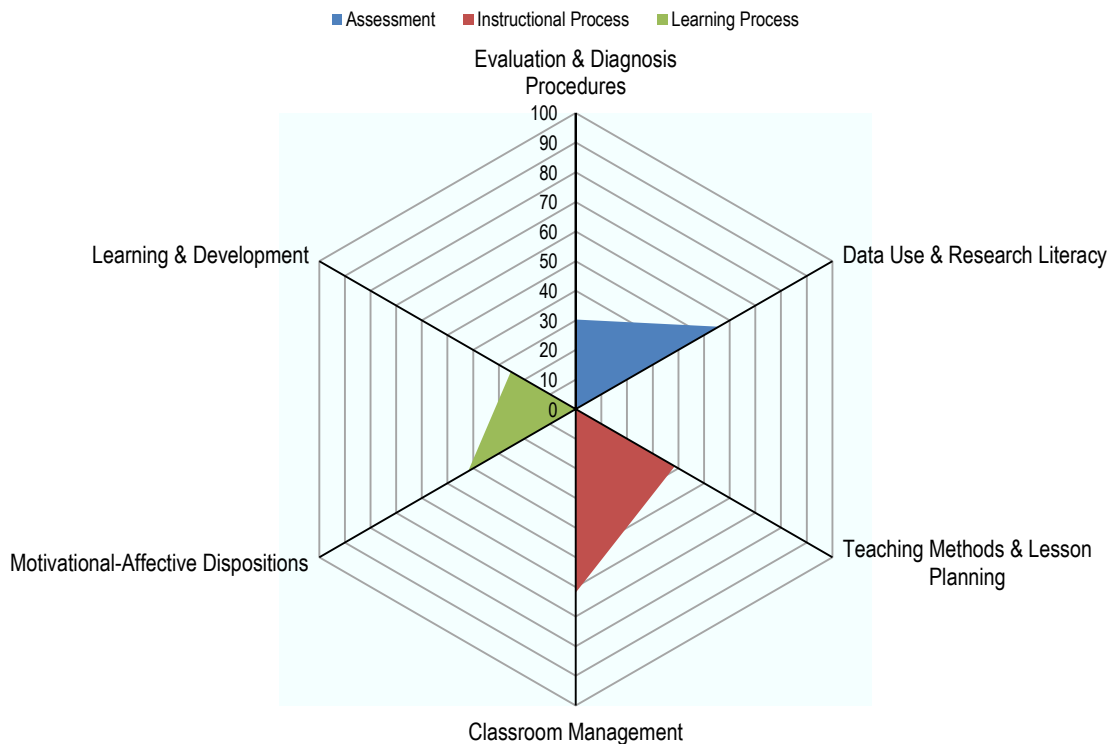
30. A higher proportion of teacher candidates achieving at least 60% correct items on the Instructional dimension can be seen from the relatively tall “isosceles” triangle in the graph above, albeit with a slight leaning towards the Assessment axis in this case.

31. At the sub-dimensional level (Graph 12), for the dimension Instructional Processes 61.88% of the respondents scored at least 60% correct in the classroom and 38.56% scored 60 or over in the teaching methods and lesson planning items.

32. For the dimension Learning Processes, 41.97% scored at least 60 correct on items capturing motivational and affective dispositions while 25.33% scored at least 60 in the learning and development items.

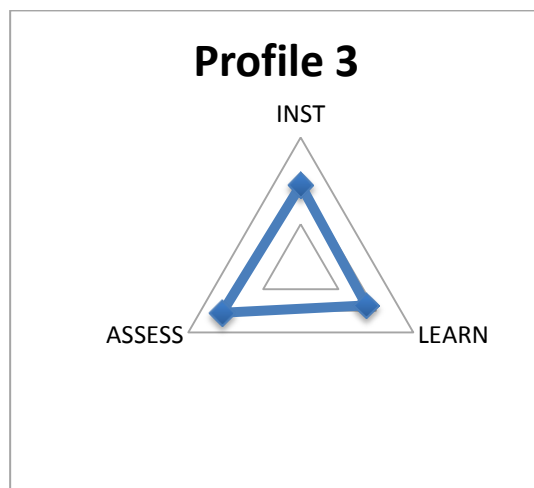
33. For the Assessment dimension, 55.69% of respondents scored at least 60% correct in the Capturing Data Use and Research Literacy while just 30.27% scored over 60 in the Evaluation and Diagnosis Procedures items.

Graph 12. Profile: Teacher candidates in Country B- Sub Dimensions



34. *Profile 3: Balanced dimensions:* is typified by relatively similar proportions of participants scoring above 60 in all three dimensions, although the Assessment dimension typically still comes out on top (Graph 13). It is only seen amongst the Teacher Educators, specifically in Country E and Country B.

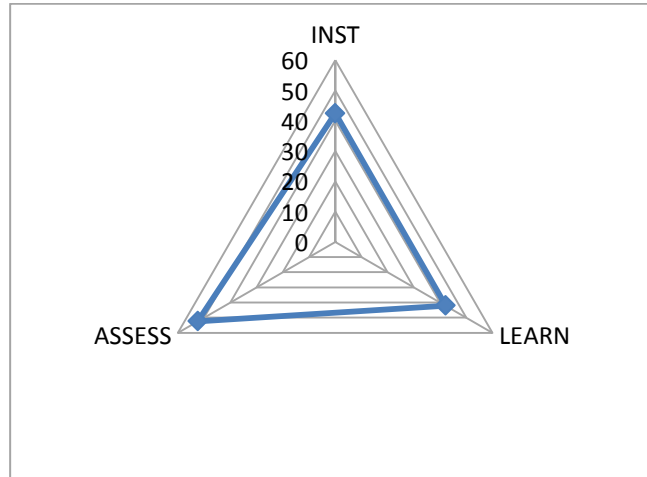
Graph 13. Profile 3



35. Teacher Educators in Country B exhibit a balanced dimensions knowledge base, characterised by fairly similar proportions of respondents scoring more than 60 in all three dimensions. 52.3% of respondents scoring 60 or more in the Assessment knowledge items followed by 42.45% on the

Instructional Processes and 42.1% on the learning and development items. This can be seen clearly in the even “equilateral” triangle shape seen in Graph 14 below:

Graph 14. Profile: Teacher Educators in Country B

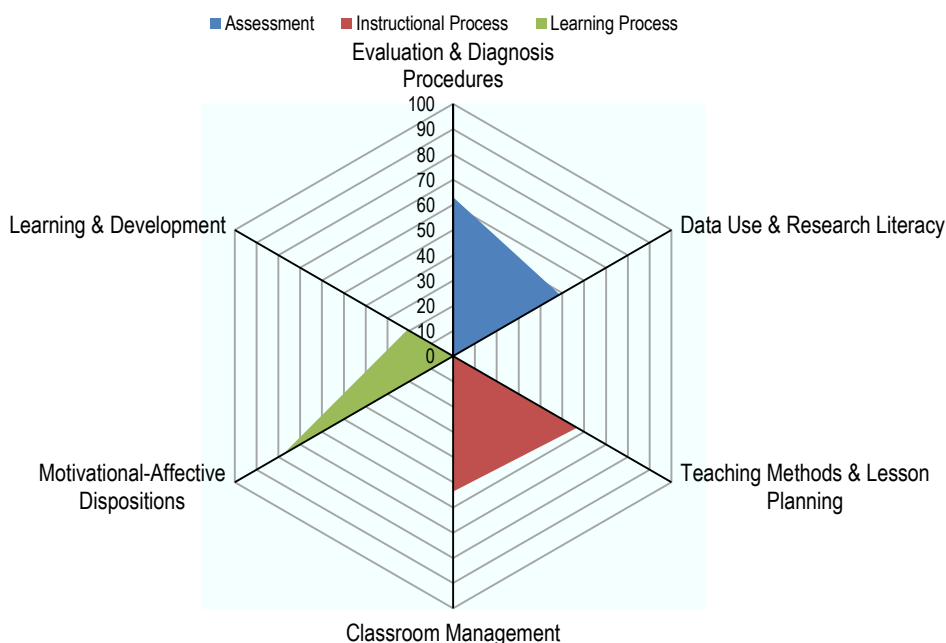


36. Delving deeper (Graph 15), within the Instructional Processes dimension 53.67% of respondents scored at least 60% correct items in the Classroom Management items and 56.76% in the Teaching Methods and Lesson Planning items. This shows a consistently high performance across both dimensions.

37. For the Learning Processes dimension, 78.05% scored at least 60% correct items in the Motivational and Affective Dispositions items. By contrast, only 20.93% scored at least 60% correct items in the Learning and Development items.

38. Finally, in the Assessment dimension, while 63.04% of respondents scored at least 60% correct in the Evaluation and Diagnosis Procedures items only 48.83% did so in the capturing Data Use and Research Literacy Evaluation.

Graph 15. Profile: Teacher Educators in Country B- Sub-dimensions



Overview:

39. Teacher candidates in most participating countries exhibit a model with strength on assessment (Profile 1). Teachers are also most likely to exhibit a model with strength on assessment (Profile 1), and more specifically the sub profile 1.1: High Assessment, then tending to favour Instructional over Learning. Teacher educators are more likely to be in two different categories: Profile 1.2 High Assessment, modest Learning, low Instruction in two participating countries and Profile 3 Balanced in another two. Table 2 provides an overview

Table 2. Pedagogical knowledge profiles by country and sample

	Country A	Country B	Country C	Country D	Country E
Teachers	P1.2	P1.1	P1.1	P1.1	P1.2
Teacher Candidates	P1.3	P2	P1.1	P1.1	P1.3
Teacher Educators	P1.2	P3	P2	P1.2	P3

40. The TKS pilot study is designed to provide initial insights on what extent teachers have the knowledge and skills for teaching 21st century skills. Skills such as creativity, critical thinking, metacognition, collaboration, problem solving are the 21st century skills that teachers are required to help their students develop (i.e. Pellegrino, 2017). The TKS includes items assessing teacher’s knowledge of what they know about a creative learner, or what they know about the best practices for promoting critical thinking. All the items included in the assessment instrument of teachers’ pedagogical knowledge are based on rigorous and current evidence (for more information please see [EDU/CERI/CD\(2016\)3](#)). The items were grouped based on their thematic orientation, i.e. whether an item measures the knowledge of

core concepts/phenomena of teaching and learning or more recent key demands for 21st century teaching (Labelling: Core knowledge, Key demand for 21st century teaching). For in-service teachers the ‘Key Demand for 21st century teaching’ dimension consists of 8 items, while the ‘Core knowledge’ of 27 items.

41. Initial findings suggest there are country variations between what teachers know with respect to 21st century teaching versus core knowledge. For example, in ‘key demands for 21st century teaching’ teachers in Country A, B and D perform better on the average (mean scores: 4.7; 4.6 and 4.9 respectively) than in Country C and E (mean scores: 3.9 and 3.4 respectively), whereas in ‘Core knowledge’ teachers in Country A and D perform better (mean scores: 13.9 and 14 respectively) than in Country B, C and E (mean scores: 13.3, 13.11 and 12.3 respectively). Further analysis of the data will also provide insights into teachers’, teacher candidates’ and teacher educators’ knowledge of some specific topics, such as collaborative learning or metacognition.

Opportunities to learn and knowledge dynamics

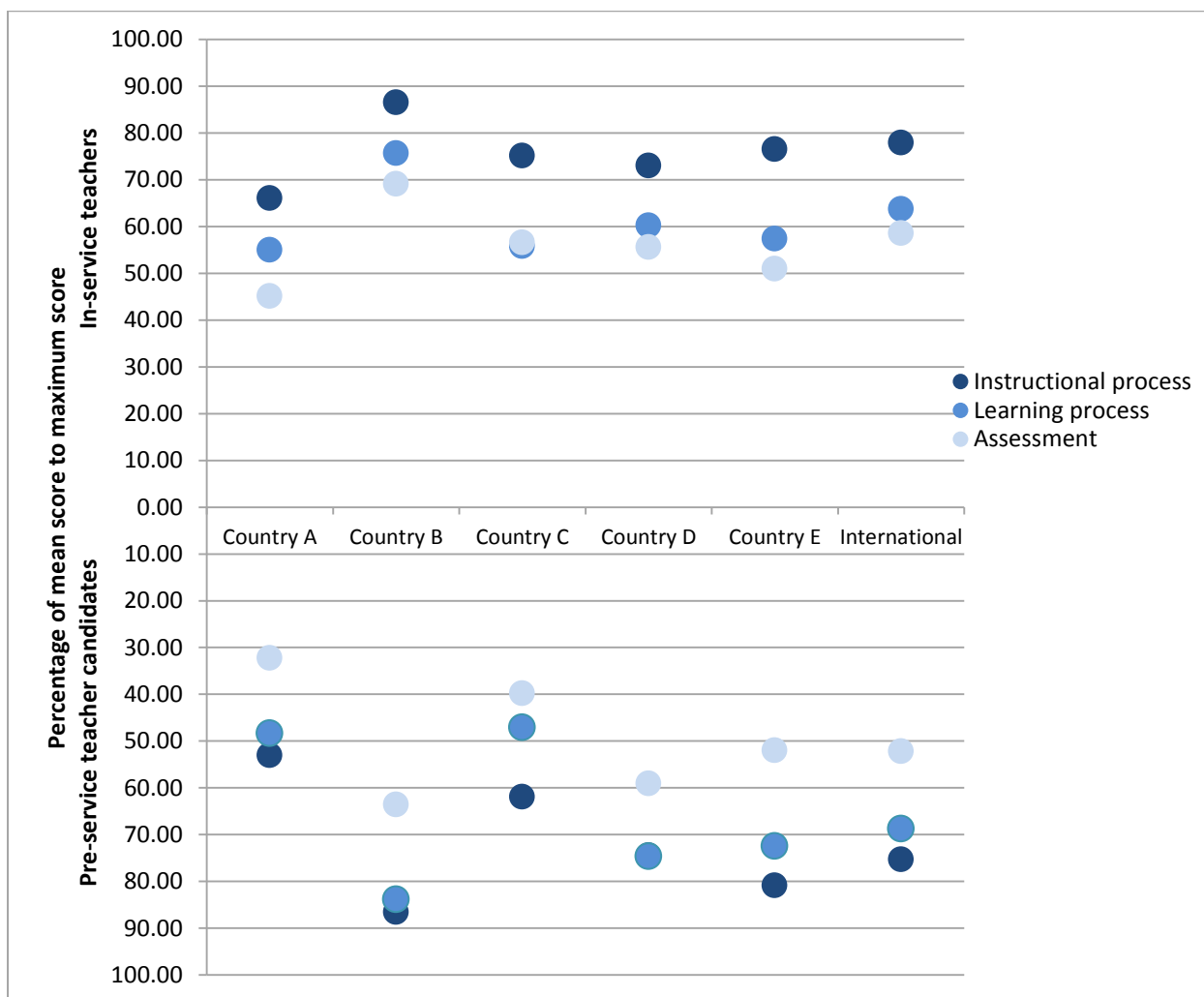
42. High-quality learning opportunities are a fundamental condition for improving teachers’ competence including their subject-specific and pedagogical knowledge (Blömeke, 2017; Schmidt, Cogan and Houang, 2011; Schmidt et al., 2008; Schmidt et al., 2007). The ITEL Teacher Knowledge Survey contributes to better understanding *whether and to what extent teacher education programmes provide teachers with opportunities to learn the knowledge and skills for effectively teaching students in the 21st century society*. The pilot implementation of the survey focuses on opportunities to learn in initial teacher education for teacher candidates and in all studies (including initial preparation and professional development) for teachers. The survey looked at various aspects of opportunities to learn including its scope and quality (see ‘Table 1’ in the Annex).

43. The items were based on previously validated instruments, in particular, the Teacher Education and Development Study – Learning to teach Mathematics (TEDS-M¹) instrument and the EMW-study². To measure teachers’ engagement in and with research, as well as their professional collaboration with different groups, new items were developed. In the following we illustrate the results of descriptive and predictive analyses and focus on the conclusions with regards to the instruments’ analytical potential and recommendations for the main study.

Content of opportunities to learn and its relation to knowledge

44. The pedagogical content items cover a large scope with 45 specific content elements. These have been categorised in the three main dimensions of the pedagogical knowledge assessment framework – instructional process, learning process, assessment and research literacy. Figure 4 (see also in [EDU/CERI/CD\(2017\)2](#), pp. 13. Figure 2) shows the proportion of pedagogical content areas teachers and teacher candidates report having had the opportunity to learn in the three main dimensions. Data clearly suggests that content related to the instructional process, that includes teaching methods, planning and structuring pedagogical units and classroom management, is dominant both in initial teacher education and in professional development. In all participating countries but country A teachers and teacher candidates report having learnt on average more than 70% of topics in this area. The domain of assessment and research literacy on the other hand seems to play a less important role: in four out of five countries – with the exception of country B – both teachers and teacher candidates report to have learnt less than 60% of the topics related to this topic on the average, and in certain cases, such as teacher candidates in country A and country C, it is less than 40%.

Figure 4. Proportion of pedagogical content areas learnt in the three main dimensions

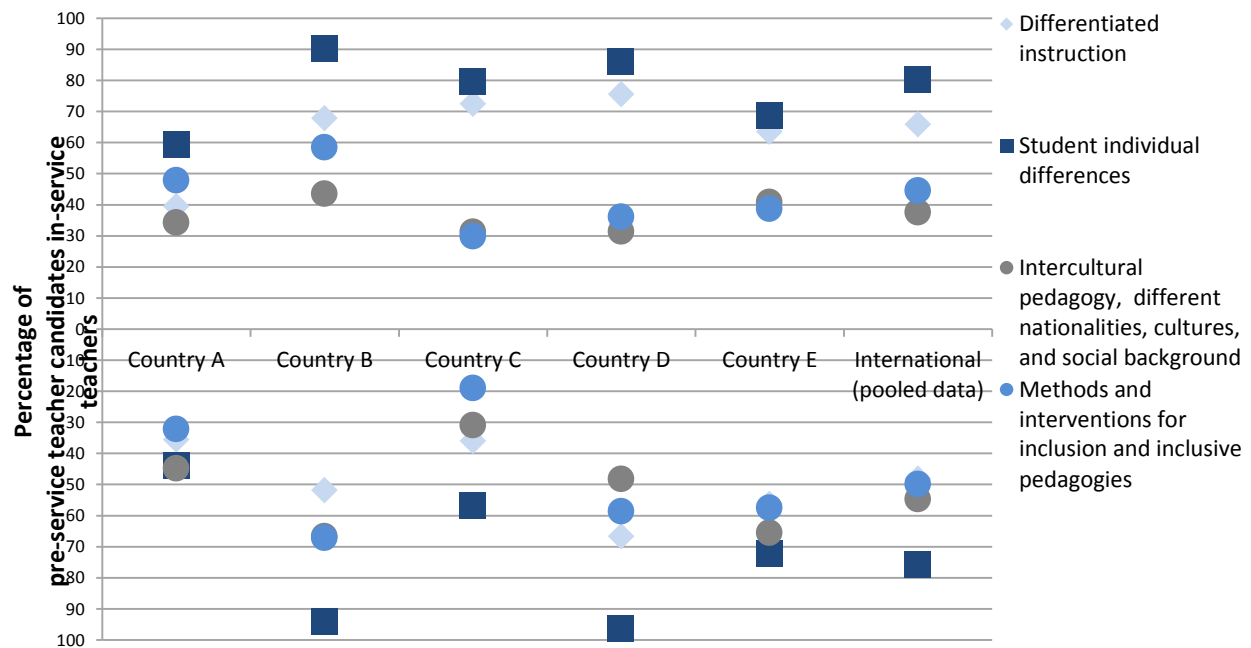


Source: ITEL TKS Database, 2016.

The average proportion of the learnt content areas (percentage of mean score to maximum value) specified in the three given dimensions of in-service teachers and pre-service teacher candidates.

Teaching diverse classrooms

45. Besides the three main dimensions of the assessment framework the instrument allows exploring other specific domains of pedagogical knowledge. One such group can be referred to as “teaching diverse classrooms”. Teachers today work with increasingly more heterogeneous groups of students. Working with diversity and adapting teaching methods to the individual differences and needs of children has become a key competence requirement of teachers (Toledo-Figuero, Révai and Guerriero, 2017; OECD, 2010). The ITEL TKS includes a number of items specifically related to this broad competence topic that encompasses a range of specialised knowledge, skills and attitudes (see Box 1. in the Annex).

Figure 5. Opportunities to learn: Pedagogical knowledge for teaching diverse classrooms

46. Data shows that while some elements, such as students' individual differences and, for teachers, differentiated instruction seem to stand out as stronger elements in teacher education in most countries; teachers have considerably less opportunities to learn about other areas, such as intercultural and inclusive pedagogies (see Figure 5). While fighting for inclusion and reducing inequalities in education systems are complex problems, teachers' pedagogical knowledge undoubtedly plays an important role. On the whole, the data suggests that many aspects of diversity pedagogy are not yet integral parts of teacher education or professional development.

Relationship to pedagogical knowledge

47. It was hypothesised that pedagogical knowledge can be predicted by opportunities to learn the corresponding topic or concept³. Thus, for example, we might expect that if a teacher candidate had the opportunity to learn about forms of motivation, they would be more likely to answer an item related to motivation correctly. This relationship has been tested through several statistical analyses, but a clear link was not found. First, correlational analysis between the main dimensions of opportunities to learn and the pedagogical knowledge scores of the corresponding assessment dimension, showed no particular links. Second, pedagogical knowledge items were matched with one or more directly corresponding opportunities to learn items on a theoretical basis and logistic regressions were calculated for these corresponding pairs. While results show no consistent pattern and no strong direct relationships, opportunities to learn is more clearly associated with knowledge in some specific cases and certain tendencies can be identified.

48. Data suggests (see Table 3) that teachers' opportunities to learn are related to their knowledge most in country D and in country E, where more than half of the knowledge items can be, to a certain extent, predicted by whether they have learnt the related topic(s). In most countries there is a stronger relationship between the opportunities to learn and the corresponding knowledge of teacher candidates. This can be explained by the fact that content learnt in initial teacher education is still a fresh and on-going experience for teacher candidates, whereas teachers responded with regards to the content of their initial

training and professional development, some of which might refer to a more distant past experience. For teacher candidates, country C and country E show the strongest link between learning and knowledge.

Table 3. Percentage of pedagogical knowledge items that show a relationship with corresponding opportunities to learn

Percentage of pk items that can be predicted by specific OTL items by country		Inter-national	Country A	Country B	Country C	Country D	Country E
In-service teachers	All pedagogical knowledge items	55%	43%	38%	40%	57%	55%
	Instructional Process	63%	50%	56%	25%	63%	56%
	Learning Process	57%	43%	21%	57%	50%	57%
	Assessment and Research Literacy	47%	35%	35%	41%	59%	53%
Pre-service teacher candidates	All pedagogical knowledge items	63%	52%	50%	59%	33%	65%
	Instructional Process	75%	38%	50%	63%	31%	38%
	Learning Process	46%	46%	54%	38%	8%	85%
	Assessment and Research Literacy	61%	67%	44%	67%	50%	72%

Source: ITEL TKS Database, 2016. Annex N. Table M.

49. The table shows the percentage of pedagogical knowledge items that can be predicted by the corresponding opportunities to learn items with an odds ratio larger than 1 per country for each main dimension.

50. A comparison between the typical models of pedagogical knowledge profiles described above and the opportunities to learn the three main dimensions indicates a discrepancy between knowledge and the opportunities to learn. While teachers and teacher candidates in the sample have the strongest pedagogical knowledge in the domain of assessment, this domain is studied the least extensively. A potential explanation is that this knowledge is acquired through informal (or non-formal) learning. Further analysis will be conducted to explore this possibility, for example, through using professional collaboration, or years of experience as proxies to account for opportunities of informal learning.

51. Overall, a weak connection between learning opportunities and pedagogical knowledge may be due to a number of factors:

- A discrepancy between OTL and pedagogical knowledge items, i.e. the actual content taught regarding a certain topic in teacher education and the specific knowledge required to answer the ITEL assessment instrument. (For example, teacher candidates or teachers might report having learnt about “Forms of working in the classroom (e.g., assigning and managing individual, pair, group and whole class work)”, but may not be able to correctly answer a pedagogical knowledge item on when teacher’s lecture is a suitable method.) This may also be a reason why few predictive relationships between OTL and GPK were detected in analyses of the sample data.
- A weak link between theory and practice in teacher education. I.e. teachers and candidates might acquire theoretical/scientific knowledge about educational concepts or areas, which can be reflected in their responses with regards to opportunities to learn, but they might not be able to translate this into classroom practice. This argument is only valid if the knowledge assessment instrument measures not only theoretical/scientific, but also practice-based knowledge (i.e. the ability to apply a professional judgement deriving both from theoretical knowledge and contextually-specific experiences to answer classroom or situationally-phrased context-specific items).

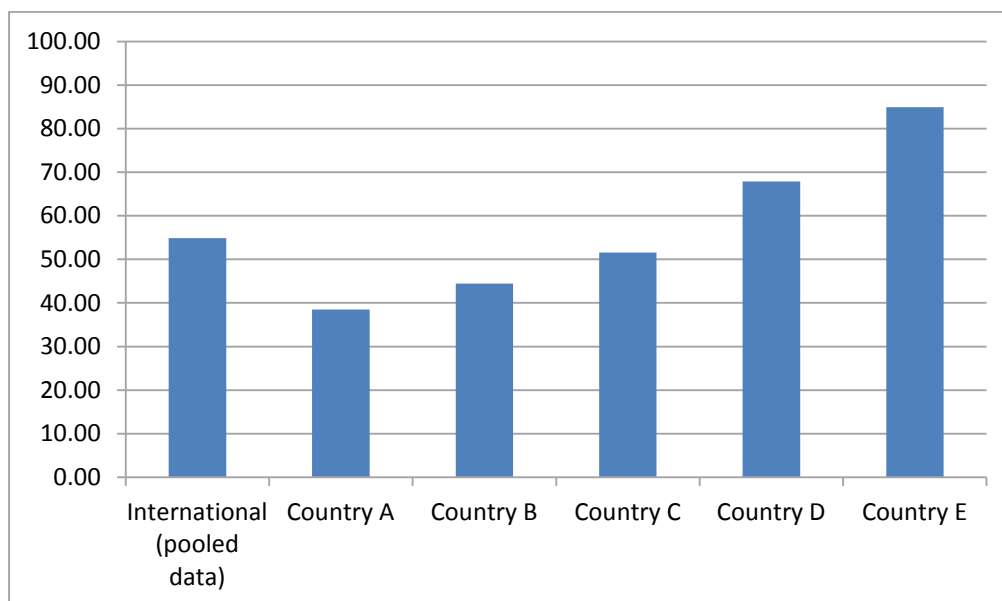
Teaching practicum

52. Teacher candidates’ field experiences are key to enhance experiential knowledge, and help them putting theory to practice. The ITEL TKS looks at the components of teaching practicum and their quantity; the scope of activities it includes and the forms and nature of professional support teacher candidates receive.

53. Data shows a rather large variation with regards to the components of teaching practicum in initial teacher training. Over 90% of pre-service teacher candidates report having had the opportunity to observe lessons, whereas giving lessons seems to be an integral part of initial training in some, but not all countries. There is also variation in the number of lessons taught during teaching practicum both between and within countries: a large proportion of teachers in country A and country C reported that they only gave 1 to 10 lessons in the presence of a teacher, while in 37% of country B, 46% of country E and 64% of Country D teacher candidates gave more than 20 lessons during their teaching practicum.

54. With regards to professional support, the instrument looks not only at whether teacher candidates are accompanied by a mentor teacher, but also the ways in which they are supported. For example, are their reflective skills developed, or do they get substantive feedback on how to improve. ITEL TKS data indicates that in some countries experiencing that a teacher asks questions about the class taught and encourages candidates to reflect is not a general common practice during field experience. Only in country E was such an experience reported by the vast majority – more than 80% – of teacher candidates (see Figure 6).

Figure 6. The percentage of pre-service teacher candidates who experienced that a teacher asked them questions about their class, which encouraged them to reflect



55. On the whole, exploring different aspects of teaching practicum is valuable to gain a better picture of how teacher candidates' knowledge is fostered. Initial analysis, however does not show that the quantity of teaching practicum directly predicts knowledge, although regression analysis may yield different results on larger samples.

Quality of opportunities to learn

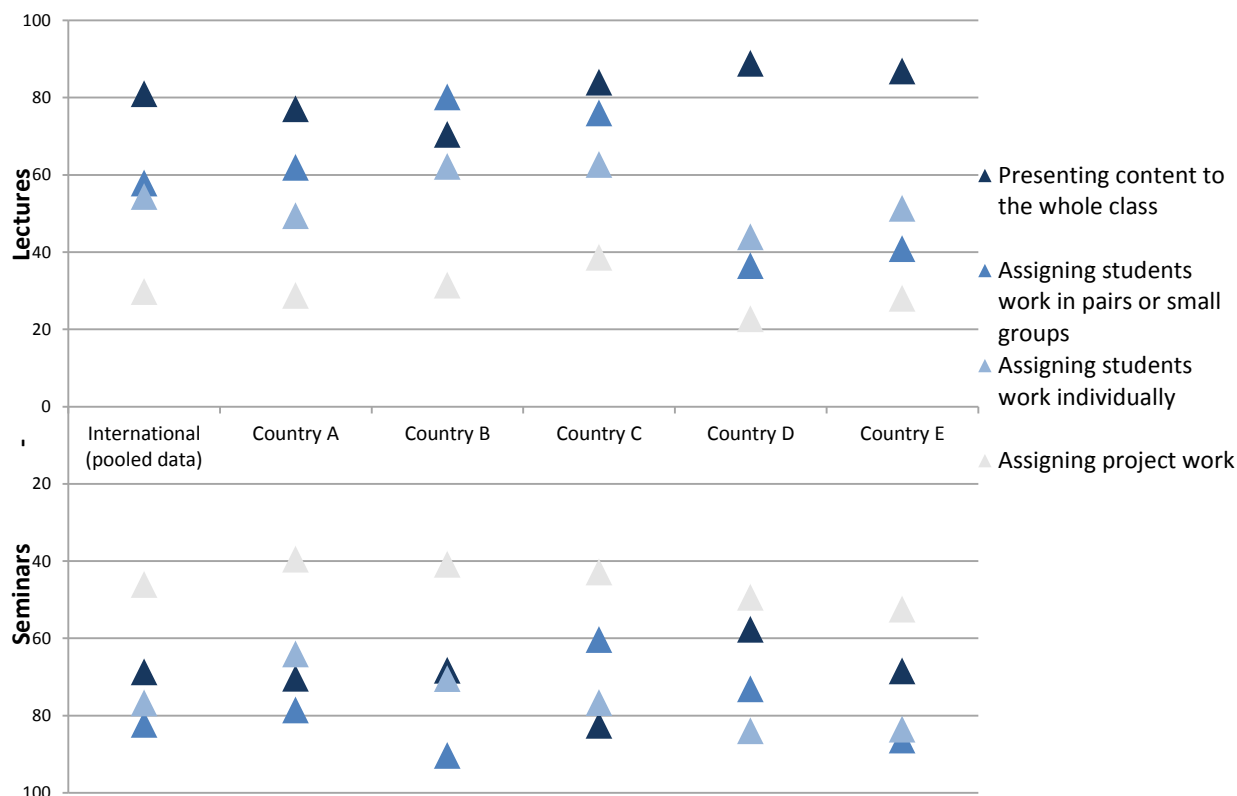
56. Evidence on the effectiveness of teacher education programmes (including professional development) suggest that actively involving participants in their learning is positively related to changing practices and improving student learning, moreover collaborative professional development programmes have more of an impact on teaching practices than non-collaborative ones (Cordingley, 2008; Cordingley et al., 2005; Desimone et al., 2002; Garet et al., 2001). A recent systematic review also concluded that teacher collaboration has positive effects on student achievement, on teachers, as well as the whole school level (Vangrieken et al., 2015).

57. Data of the ITEL TKS indicate that while suggestions and ideas seem to be valued in initial training and professional development in most participating countries, direct involvement in the design and organisation of the courses, and in the selection of topics is far less common. In general, participants' agency over the content and organisation of the courses seems quite low across countries and samples. Collaboration and professional dialogue is characteristic to teacher education to a varying extent in the countries, for example, in country D significantly lower proportion of teachers report team work and active contribution to discussions in professional development than in country B (see Figure 7).

Figure 7. Quality of opportunities to learn in initial teacher education and professional development



58. In parallel to the self-reported quality of initial teacher education of teacher candidates, the ITEL TKS also looks at what teacher educators report with regards to the methods they use in their lectures and seminars. While presenting content to the whole class is dominant in lectures, making students work in pairs and small groups or individually is not uncommon either. In country D and country E clearly whole class work dominates in lectures, other forms of activities in these countries are significantly less characteristic. For example, project work is somewhat more frequently assigned in seminars than in lectures in all countries, but it remains a considerably less typical form of assignment, with less than half of teacher educators reporting that they use this form sometimes or often (see Figure 8).

Figure 8. Opportunities to learn: Methods used by teacher educators in lectures and seminars

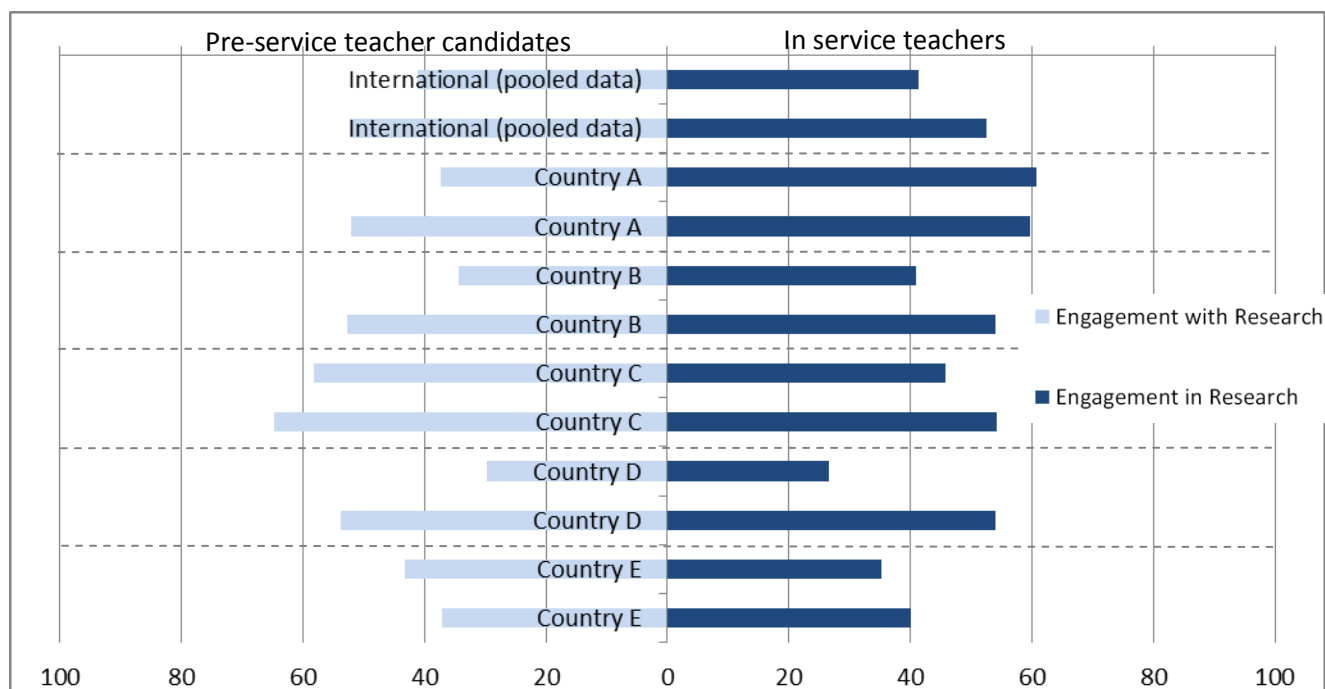
59. Evidence indicates that the ways in which teachers and teacher candidates learn in teacher education affects their own teaching in turn. The ITEL TKS instrument provides insight into the quality of teacher learning in formal programmes, and thus has the potential to draw conclusions on how these can be improved.

Knowledge dynamics in the profession

60. Education is often accused of lacking evidence-based practice, and education research of not being relevant and applicable for teaching practice (e.g. Hargreaves, 1996; Dumont, Istance and Benavides, 2010; Levin, 2011; Goldacre, 2013). Helping bringing research and practice closer can involve producing research outputs that are easily accessible for teachers (or making them accessible), but also giving teachers sufficient background in research to be able to interpret research and evaluate its relevance for practice. The dynamics between the production and the use of research is facilitated by the interactions and collaborations between different stakeholders. While teachers' knowledge – whether individual or the collective knowledge base of communities or the profession – is constantly changing through various processes such as experience and learning, evidence about the nature and extent of this dynamic seems weak and controversial (Révai and Guerriero, 2017). The ITEL *Teacher Knowledge Survey* investigates knowledge dynamics to shed some new light on this issue through empirical research.

Engagement in and with Research

61. TKS investigates engagement with and in research, i.e. the different ways in which teachers use existing research evidence and the forms of active participation in the research process.

Figure 9. Teachers' and teacher candidates' engagement in and with research

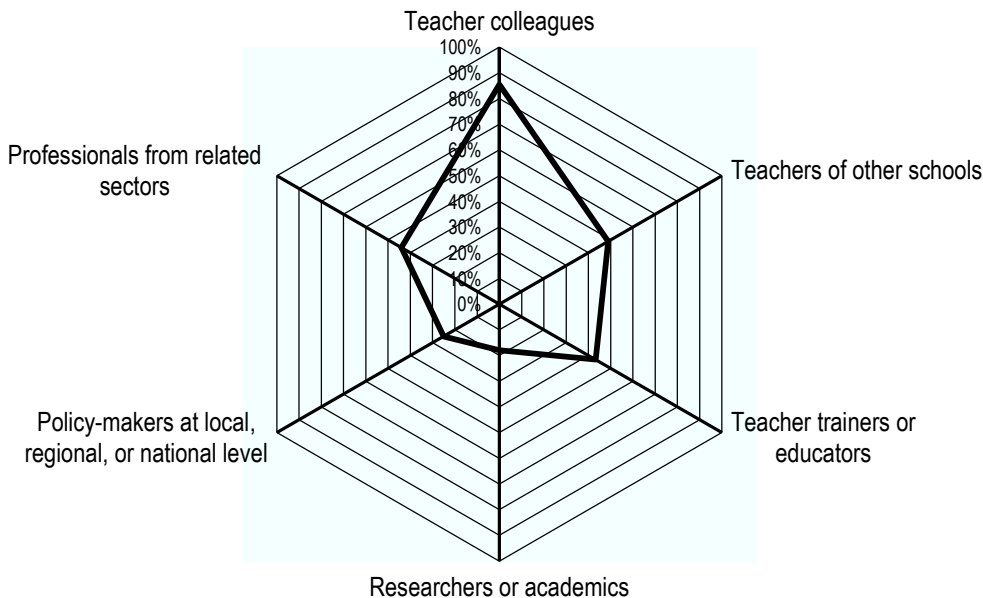
62. Not surprisingly, across the three samples respondents consistently report engaging more with research rather than actively engaging in the research process. Only slightly more than half of the teachers report that they engage with research in some way across the participating countries, mostly by reading research papers. Fewer reported engagement by analysing or evaluating research findings although there is some variation between countries (see Figure 9). Globally less than half of the teachers reported being involved in research activities – although there were large differences between countries (ranging from 27% to 61%).

63. Teacher candidates show, on the whole, a very similar pattern to teachers in terms of engagement with and in research. We find however a striking difference in country C, where only half of the teachers in the sample read educational science research, as opposed to 90% of teacher candidates. Such findings suggest a change in the focus and curriculum of teacher education, moving towards a more evidence-based agenda in certain countries, whereas less change in others. Data collected from the institutions, as well as data on teacher educators' engagement in and with research, contribute to better interpreting such findings.

Professional collaboration

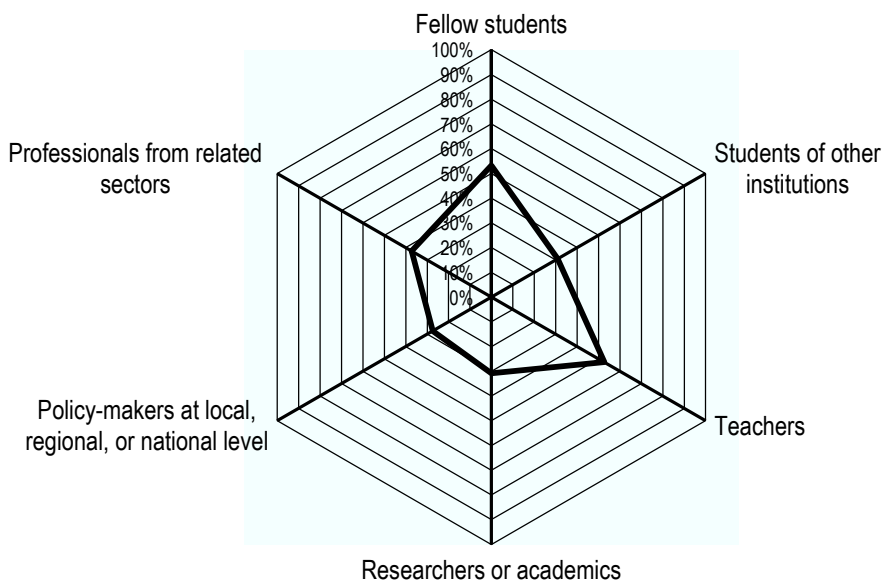
64. To explore the social dimension of teachers' knowledge dynamics, the ITEL TKS looks at teacher candidates', teachers' and teacher educators' professional networks, including the diversity of the different groups of actors they collaborate with to improve teaching and learning, and the frequency of collaboration. The data shows a very low level of co-operation between teachers and researchers in all countries, which is in line with evidence cited earlier. On the whole teacher candidates' level of collaboration is relatively low with all the stakeholders, they work most frequently together with teachers, which in certain countries may refer to their relationship with the mentor teachers during field experience. Teacher educators – besides their own colleagues – report to collaborate with teachers more frequently than what we see vice versa in the teacher sample. This may indicate that more frequent and stronger collaboration only exists between a limited network of schools and the teacher education providers (see Figures 10-12).

Figure 10. In-service teachers' professional network (international - pooled data)



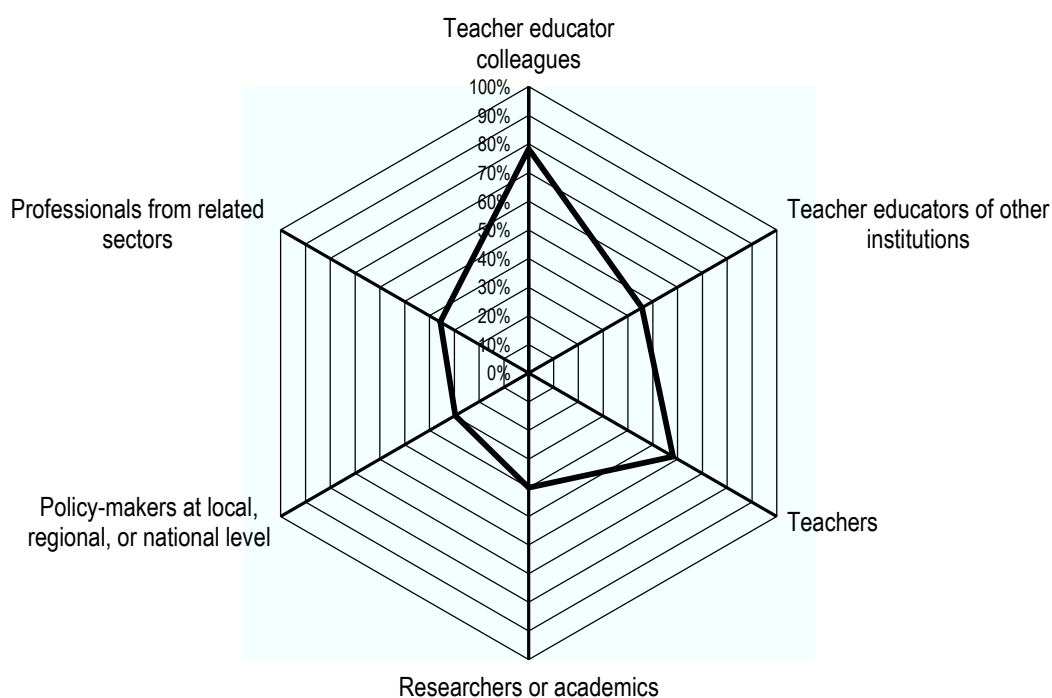
Note: The percentage is the weighted average of the percentages of respondents answering 1-4 on the scale, weighted by the frequency of collaboration, where the weights are 0 for “never”, 1 for “Rarely, about once a year”, 2 for “Sometimes, about 4-6 times a year” and 3 for “Often, at least monthly”.

Figure 11. Pre-service teacher candidates' professional network (international - pooled data)



Note: The percentage is the weighted average of the percentages of respondents answering 1-4 on the scale, weighted by the frequency of collaboration, where the weights are 0 for “never”, 1 for “Rarely, about once a year”, 2 for “Sometimes, about 4-6 times a year” and 3 for “Often, at least monthly”.

Figure 12. Teacher educators' professional network (international - pooled data)



Note: The percentage is the weighted average of the percentages of respondents answering 1-4 on the scale, weighted by the frequency of collaboration, where the weights are 0 for “never”, 1 for “Rarely, about once a year”, 2 for “Sometimes, about 4-6 times a year” and 3 for “Often, at least monthly”.

Relationship between collaboration and engagement in/with research

65. The ITEL TKS study captures some aspects of the complex interplay between knowledge production and use, and the social processes through which teachers’ knowledge is shaped. The question the study investigates specifically is “how do teacher candidates’ and teachers’ professional networks relate to their research activities?”. Correlation analysis suggests that teachers’ and teacher candidates’ professional collaboration is positively associated with their engagement in and with research (although not strongly). Table 4 (see also in [EDU/CERI/CD\(2017\)2](#), Table 5 shows the coefficients and their significance by country.

Table 4. Correlations between professional collaboration and engagement in and with research

In-service teachers	Engagement in Research	Engagement with Research
Professional collaboration and Research activities	Correlation coefficient	Correlation coefficient
Country A	0.2196	0.2857**
Country B	0.381***	0.3929***
Country C	0.3188***	0.3508***
Country D	0.2672*	0.1256
Country E	0.3815***	0.3296**
Pre-service teacher candidates	Engagement in Research	Engagement with Research
Professional collaboration and Research activities	Correlation coefficient	Correlation coefficient
Country A	0.2863	0.4132*
Country B	0.1891**	0.3712***
Country C	0.1914	0.3003*
Country D	0.3044	0.3044
Country E	0.2004	0.3333**

Note: ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.5$

66. On the whole, the ITEL TKS pilot data seem to confirm that teaching practice is not yet strongly research-based across the countries. The instrument also has the potential to provide a deeper insight into the different aspects driving the knowledge dynamics in the teaching profession. Further development of the knowledge instrument could allow to investigate how well teachers are prepared to use research to improve their practice, and what are the components of learning opportunities that predict this competence.

Motivation

67. Motivation is an important element of teachers' professional competence to explore, and it is essential to differentiate amongst different constructs within motivation when looking at effects on teacher knowledge, competence and professional development. There is research suggesting, for example, that individuals who are highly intrinsically motivated outperform their less intrinsically motivated peers, as well as those who are more driven by extrinsic motivations such as salary (Baker, 2004). Specifically in the teaching profession, Brouwer and Brinke (1995) for example found that pre-service teachers with high levels of intrinsic motivation reported higher pedagogical competence than their less intrinsically motivated colleagues. Due to the potential interplay between motivation, knowledge and opportunities to learn, it is imperative to explore as one of the drivers of professional competence within the teaching profession.

68. The ITEL Teacher Knowledge Survey is looking to answer research questions that are more central to the notions of motivation as both a predictor and an outcome of general pedagogical knowledge, and how opportunities to learn and motivation can predict one another as well. For example, are teachers who are more intrinsically motivated by factors such as having a genuine interest in working with children, rather than those driven by salary or occupational attainment, making more use of professional development opportunities? And does this affect overall general pedagogical knowledge attainment?

69. The pilot survey explored motivation in the in-service and teacher candidate samples in each of the five participating countries. In the development phase of the ITEL Teacher Knowledge Survey, the

possibility of adapting the motivation scales to the specifics of the teacher educator sample (such as including hypothetical situations about teachers) was discussed. However, prior to the pilot study, there was not enough information concerning the specific characteristics of this population. Generally, teacher educators can be a very heterogeneous group, as some might be teachers, others researchers and some may fall into both categories. Adapting the motivation scales for teacher educators would have involved some guesswork in terms of how and for which target population to adjust the scales. Also, there were concerns about the length of the assessment for this sample, therefore the focus for teacher educators would be on the knowledge items. There will be a possibility to adapt the motivation scales for the main study. It is important to note that all scales currently used in the ITTEL TKS for the in-service and pre-service samples have previously been validated. For example, items from the FIT-Choice Scale that was developed to measure factors influencing the choice to teach in pre-service teacher samples, was validated by its developers (Watt & Richardson, 2007).

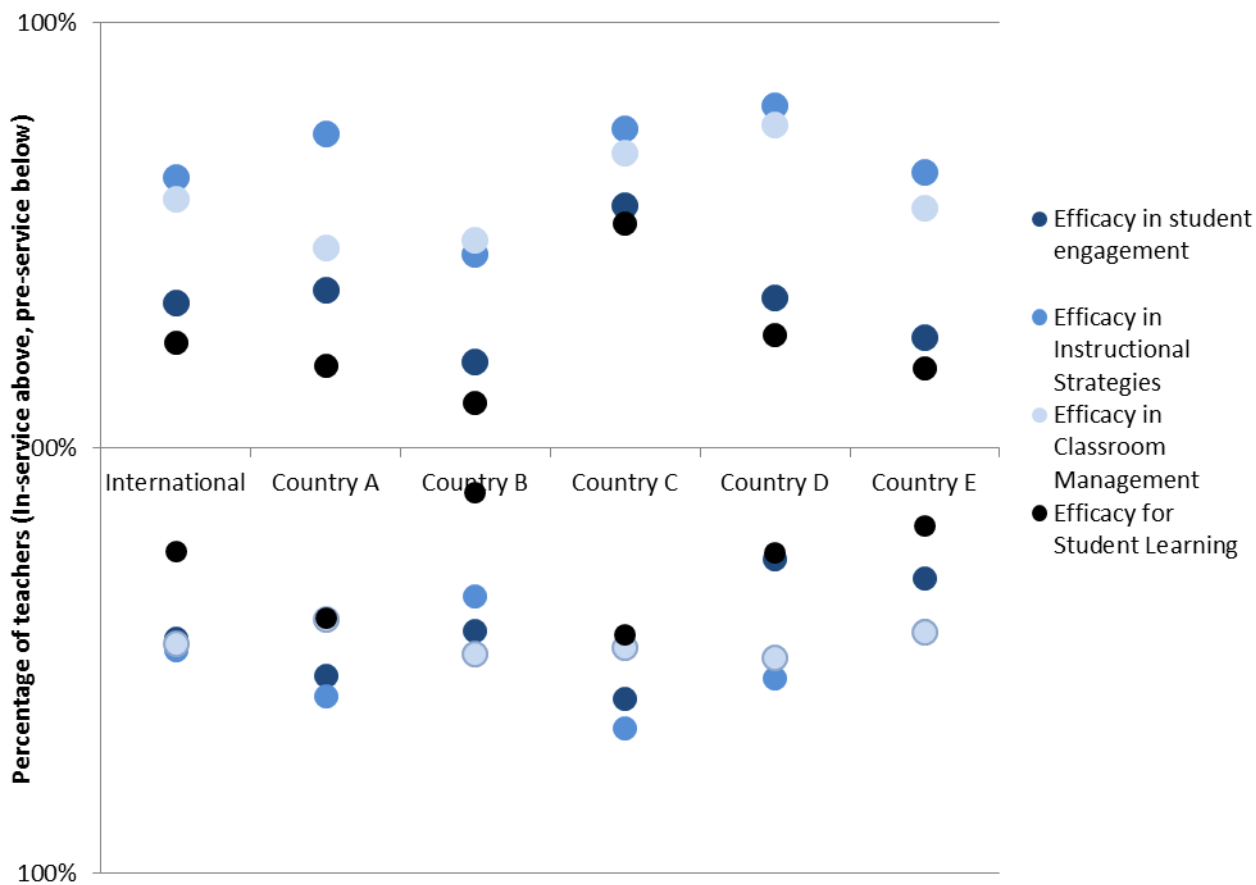
70. The following will outline an overview of some preliminary results across the different country samples for in-service and teacher candidates. The motivation scales were presented to respondents as Likert-type scales, with 7 possible responses, ranging from “1” signifying the lowest possible response to “7” signifying the highest possible response (i.e. depending on the item stem, 1 could have signified “nothing at all”, “not at all confident” or “completely disagree”, whereas 7 could have signified “a great deal”, “completely confident” or “completely agree”). Response rates presented are the addition of the proportion of respondents who chose “6” or “7” for the item in question.

Self-efficacy

71. Overall, teachers tended to report the highest self-efficacy in instructional strategies, then classroom management, followed by student engagement, with the lowest perceptions of self-efficacy reported for student learning outcomes. Country C teachers reported the most consistent perceptions of (generally high) self-efficacy across scales. The same pattern emerged where teacher candidates felt most efficacious in terms of instructional strategies, followed by classroom management, student engagement and finally student learning.

72. Across constructs, teacher candidates reported similar levels of efficacy to in-service teachers in terms of student learning, higher efficacy for student engagement (44% versus 34%), and lower overall efficacy for both classroom management and instructional strategies. This could reflect a difference in classroom experience between teachers working in the profession versus those who have yet to accumulate experience and expertise outside of a teacher education institution. Another departure from the results seen in the teacher sample is that teacher candidates from Country D reported some of the lowest levels of self-efficacy on the student engagement scale, with 10% or fewer reporting that they could do a great deal to motivate students who show low interest in school work and to work with families in helping their children do well in school. No teacher candidates in country D answered with a 7 (the highest score on the Likert-scale used) that they could assist families in helping their children do well in school (the highest score was 6). Across all five samples, teacher candidates reported the highest self-efficacy in being able to get students to believe they can do well in school work, with responses ranging from 43% of teacher candidates in country E up to 83% in country C.

Figure 13. Self-efficacy scales of in-service teachers and teacher candidates



Motivations for teaching

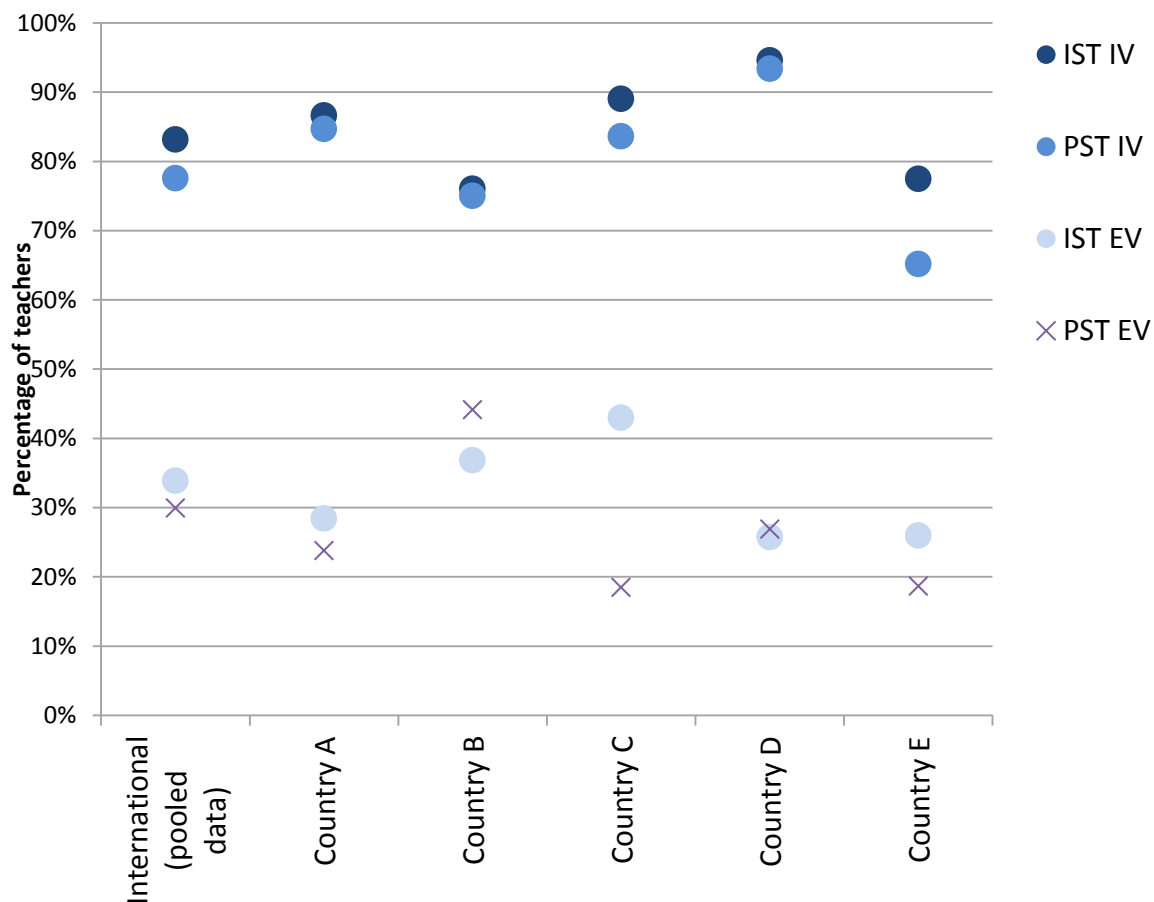
73. Overall, teachers were more inclined to rank factors of intrinsic motivation as the biggest factors leading them into a career of teaching, followed by ability, social career value and social goals, leaving extrinsic motivators, such as income and job security as some of the lowest-rated motivating factors. Teacher candidates also were more inclined to rank intrinsic motivation as a bigger factor leading them to a career in teaching than any of the other scales in the motivations for teaching construct. Teacher candidates from Country D reported the highest levels of intrinsic motivation, with over 90% finding both items in the scale ("I am interested in teaching" and "I like teaching") to be extremely important factors in choosing to become a teacher. This result was very similar to the in-service teacher sample in country D.

74. Most pre-service samples were consistent with the responses of the corresponding in-service teacher sample, however teacher candidates in Country E had over 10% difference in responses on the intrinsic motivation scale, with teacher candidates less likely to report that intrinsic factors were extremely important in their decisions to enter the profession. However, teacher candidates in country E were also less likely than their in-service counterparts to suggest that extrinsic factors, such as salary and job security, were important in influencing this decision. In fact, teacher candidates in country E were the group out of all samples across countries and across in-service and teacher candidates that were least likely to report that extrinsic factors were highly important. As with intrinsic motivation, the teacher candidate samples generally showed similar results to their in-service counterparts, except for in country C. 43% of

in-service teachers reported that extrinsic factors were very important in wanting to become a teacher versus under 20% of teacher candidates who responded the same way.

75. On a general level, hypotheses about interrelationships exist, for example in the field of motivational psychology, that highly intrinsically motivated people generally outperform less intrinsically motivated people, whereas extrinsic motivation is usually associated with poorer performance and educational outcomes (Baker, 2004). However, very few studies have specifically investigated the interrelationships between relevant cognitive and motivational elements of professional teacher competence (König and Rothland, 2012, 2013).

Figure 14. Intrinsic versus extrinsic motivation in in-service and pre-service teacher candidate samples



Self-responsibility

76. The teacher self-responsibility construct consists of four scales: self-responsibility for student motivation, self-responsibility for student achievement, self-responsibility for relationships with students and self-responsibility for quality of teaching. Results for in-service teachers on the scales quality of teaching and relationships with students were more consistent across countries than for student motivation and achievement. Overall, teachers reported that they felt more responsible for factors directly related to their own behaviour and actions as a teacher, rather than the student outcomes that result from their actions.

77. The majority of in-service teachers in each country responded that they felt completely responsible for whether their students felt cared for and could count on them for help. In the student

relationship scale, teachers in country A and country D were most likely to answer that they felt completely responsible for their relationships across all three items, with index response rates of 76% for country D and 77% for country A, versus 69% in country C, 61% in country B and 59% for country E. country B teachers were the least likely to respond that they would feel completely responsible if “a student of mine did not think that he/she can trust me with his/her problems in or outside of school” with a response rate of 42% versus 57% in the pooled sample.

78. In terms of self-responsibility for quality of teaching, teachers in country D reported the highest perceived responsibility across all items, and across all country samples the highest proportion of teachers felt most responsibility if “a lesson I taught failed to reflect my highest ability as a teacher”. 70% of teachers in the pooled sample felt highly responsible for this (led by 83% of teachers from Country D down to 62% of country B teachers), versus around 60% for the other two items in the construct. Teacher candidates tended to report higher levels of self-responsibility than in-service teachers, according to the pooled responses across each scale, however across national samples and items there is variation. As with their in-service counterparts, teacher candidates were more inclined to feel completely or almost completely responsible for elements pertaining directly to their own actions and practices, such as relationships with students and quality of teaching, than student outcomes. This is consistent with data garnered from the self-efficacy scale.

Figure 15. In-service teacher self-responsibility profiles

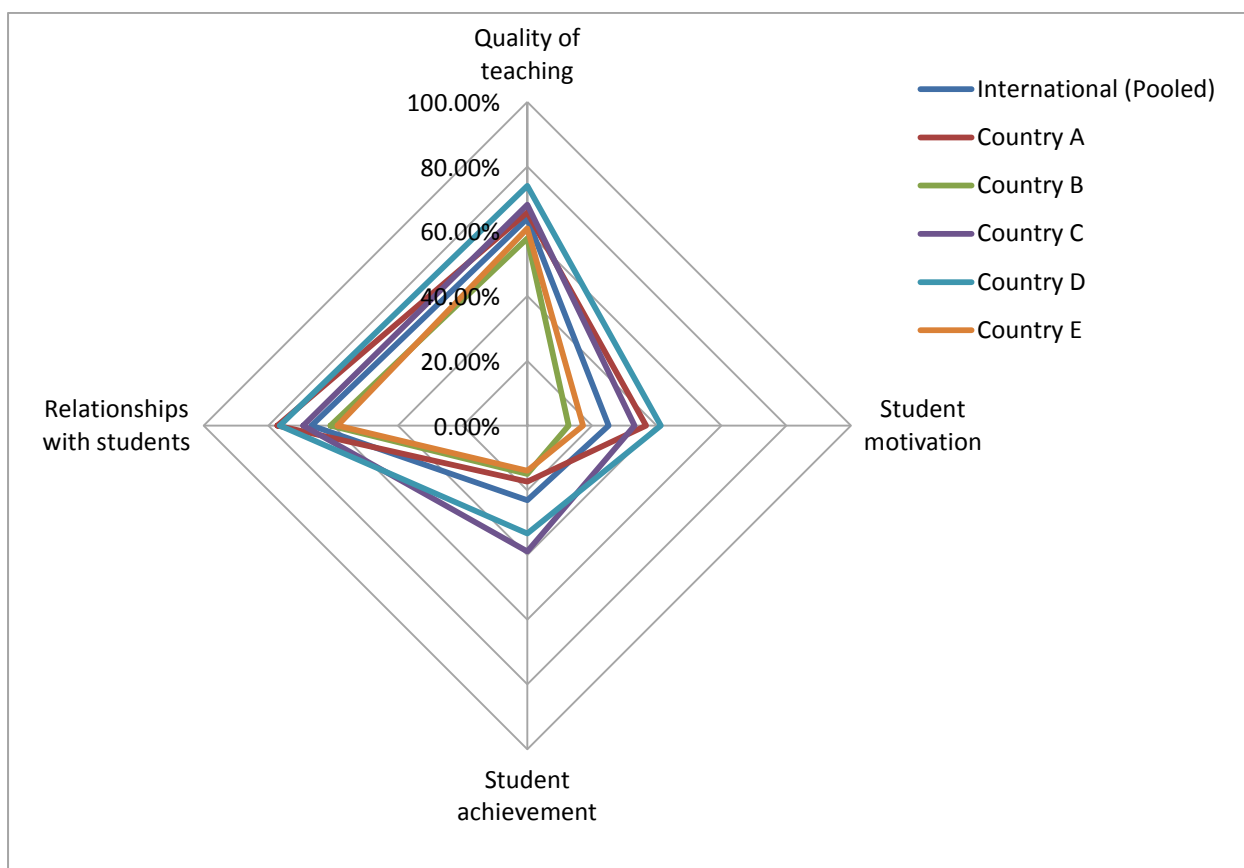
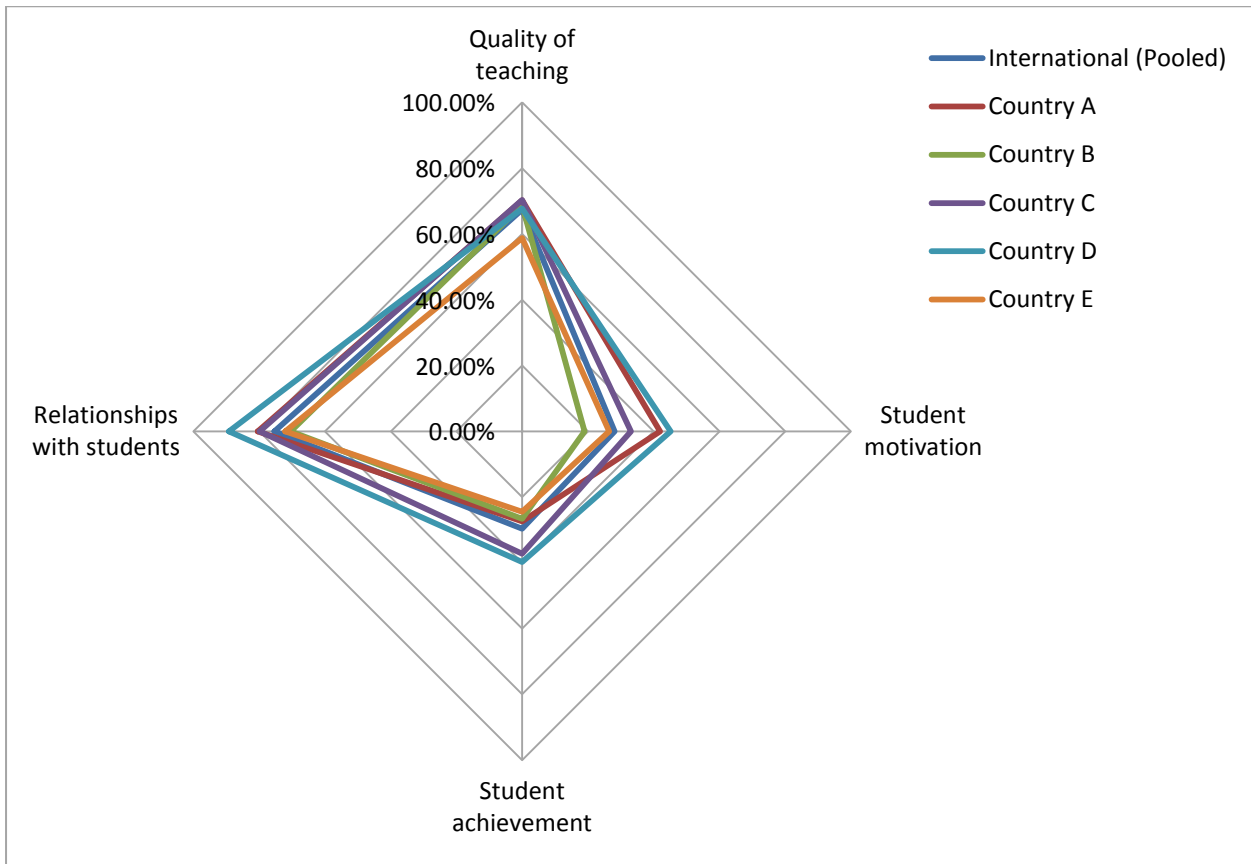


Figure 16. Pre-service teacher candidate self-responsibility profiles



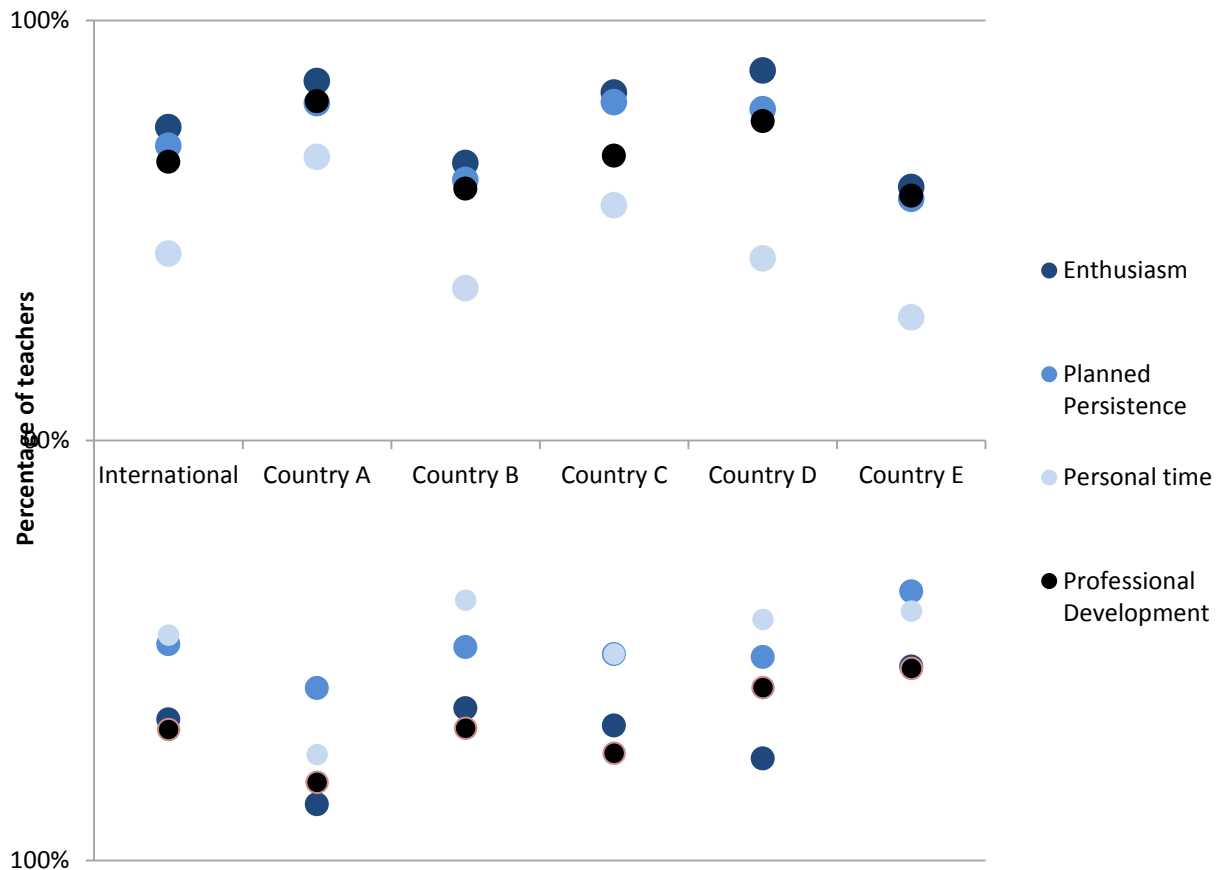
Motivation to persist in the profession

79. Across all countries, the fewest teachers responded that they would be likely to spend much of their personal time communicating with parents, while according to the pooled sample the majority of teachers would spend most of their personal time firstly on preparing good lessons (58%), and secondly to improve their teaching (53%). However, this varied across countries. For example, teachers in country D were more likely to respond that they would be more likely to spend personal time on improving teaching (57%), followed by helping students (48%) with preparing good lessons receiving only 46% of respondents suggesting they would spend much of their personal time on this task, whereas, in country A, teachers stated that they would spend most of their personal time preparing good lessons (86%), followed by improving their teaching (83%). Teachers in country A reported the highest variation in willingness to invest personal time, with a difference of 50% of respondents between the top-ranked activity (preparing good lessons) and the lowest-ranked activity (communicating with parents). In country E on the other hand, responses were more consistent with only 20% of respondents separating the top and lowest activities. Teachers in country E were almost as likely to report spending most of their personal time on working with students as with communicating with parents and helping students (23-24%). The only consistency across this scale was that teachers across samples were least likely to invest personal time in communicating with parents.

80. It is interesting to note the differences between in-service and pre-service teacher candidate sample responses across the different scales in this construct. In-service teachers are more likely than teacher candidates to report high levels of enthusiasm (75% of in-service versus 67% teacher candidates). Teacher candidates in Country A, however, were more likely to report slightly higher enthusiasm than their

in-service counterparts; however, large differences were seen in the other direction in country C and country D. The biggest difference between samples in this scale was concerning the planned persistence, where 70% of in-service teachers responded across the scale that they were highly satisfied with their choice of becoming a teacher and would persist in the profession, versus only 49% of teacher candidates.

Figure 17. Motivation to persist in the profession of in-service and pre-service teacher candidates



Relationships between motivation and In-service Instructional Quality

81. The ITEL TKS study allows for some insights into factors contributing to knowledge and professional development. The pilot study included a dimension for in-service teachers looking at self-reported instructional quality and classroom management. Items within this dimension asked teachers about their practices and behaviours within the classroom (i.e. I have individual students answer questions in front of the class, answers on a 1-4 Likert-type scale of “Never or Almost Never” to “In all or Nearly All Lessons”). Correlation analysis suggests that there tends to be a significant relationship between motivational constructs and self-reported instructional quality in the in-service teacher samples (examples presented in Table 5). For example, in-service teachers who report high levels of motivations for teaching in terms of social goals (i.e. creating deep personal relationships with each and every student), tend to report that they engage in practices that would facilitate building these relationships such as taking care of students when they have problems.

Table 5. Correlations between teacher motivation and instructional quality

In-service teachers	Self-efficacy in instructional strategies
Instructional Quality, Use of Assessment	Correlation coefficient
Country A	0.2777*
Country B	0.3296***
Country C	0.2637**
Country D	0.3057**
Country E	0.3333**
In-service teachers	Motivations for teaching, Social Goals of Teachers
Instructional Quality, Social Support for Students	Correlation coefficient
Country A	0.0141
Country B	0.388***
Country C	0.1932*
Country D	0.3434**
Country E	0.3325***

Note: ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.5$

REFERENCES

- Baker, S.R. (2004), “Intrinsic, extrinsic, and amotivational orientations: Their role in university adjustment, stress, well-being, and subsequent academic performance”, *Current Psychology*, Vol 23, pp. 189–202.
- Barrett, P. (2007), “Structural equation modelling: adjudging model fit”, *Personality & Individual Differences*, Vol. 42/5, pp. 815-824.
- Blömeke, S. (2017), “Modelling teachers’ professional competence as a multi-dimensional construct”, in: Guerriero (2017), *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, OECD Publishing, Paris.
- Brouwer, N. and S. Ten Brinke (1995), “Der Einfluss integrativer Lehrerbildung auf die Unterrichtskompetenz (II)”, [The influence of integrative teacher education on teaching competence], *Empirische Pädagogik*, [Empirical Pedagogy], Vol. 9, pp. 289–330.
- Brown, T. (2006), *Confirmatory factor analysis for applied research*, Guildford, New York.
- Byrne, B. M., R.J. Shavelson and B. Muthén (1989), “Testing for the equivalence of factor covariance and mean structures: the issue of partial measurement invariance”, *Psychological Bulletin*, Vol. 105/3, pp. 456-466.
- Cordingley, P. (2008), “Research and evidence-informed practice: focusing on practice and practitioners”, *Cambridge Journal of Education*, Vol. 38/1, pp. 37-52.
- Cordingley, P. et al. (2005), “The impact of collaborative continuing professional development (CPD) on classroom teaching and learning. Review: How do collaborative and sustained CPD and sustained but not collaborative CPD affect teaching and learning?” In: *Research Evidence in Education Library*, EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, London.
- DeMars, C. (2010), *Item response theory*, Oxford University Press, Oxford.
- Desimone, L.M. et al. (2002), “Effects of Professional Development on Teachers' Instruction: Results from a Three-Year Longitudinal Study”, *Educational Evaluation and Policy Analysis*, Vol. 24/2, pp. 81-112.
- Dumont, H., D. Istance and F. Benavides (eds.) (2010), *The Nature of Learning: Using Research to Inspire Practice*, Educational Research and Innovation, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264086487-en>.
- Garet et al. (2001), “What Makes Professional Development Effective? Results from a National Sample of Teachers”, *American Educational Research Journal*, Vol. 38/4, pp. 915-945.
- Goldacre, B. (2013), “Building evidence into education”, *Bad Science*.
- Hargreaves, D.H. (1996), “Teaching as a research-based profession: possibilities and prospects”, *The Teacher Training Agency Annual Lecture*, The Teacher Training Agency, London.
- König, J. and M. Rothland (2013), “Pädagogisches Wissen und berufsspezifische Motivation am Anfang der Lehrerbildung. Zum Verhältnis von kognitiven und nicht-kognitiven Eingangsmerkmalen von

Lehramtsstudierenden”, [Educational knowledge and job-specific motivation at the beginning of teacher training, On the relationship between cognitive and non-cognitive input characteristics of students becoming teachers], *Zeitschrift für Pädagogik*, [Journal of Pedagogy], Vol. 59/1, pp. 43-65.

König, J. and M. Rothland (2012), “Motivations for Choosing Teaching as a Career: Effects on General Pedagogical Knowledge during Initial Teacher Education”, *Asia-Pacific Journal of Teacher Education*, Vol. 40/3, pp. 291–317.

Levin, B. (2011), “Mobilising research knowledge in education”, *London Review of Education*, Vol. 9/1, pp. 15–26.

Muthén, L.K. and B.O. Muthén (2012), *Mplus user’s guide*, Vol. 7, Muthén & Muthén, Los Angeles, CA.

OECD (2010), *Educating Teachers for Diversity, Meeting the Challenge*, OECD Publishing, Paris.

Pellegrino, J. (2017), "Teaching, learning and assessing 21st century skills", in *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264270695-12-en>.

Rasch, G. (1960), *Probabilistic Models for Some Intelligence and Achievement Tests*, Danish Institute for Educational Research, Copenhagen.

Révai, N. and S. Guerriero (2017), “Knowledge Dynamics in the Teaching Profession”, in: Guerriero, S.(ed.) (2017), *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264270695-en>.

Schön, D.A. (1983), *The Reflective Practitioner – How Professionals Think in Action*, Basic Books Inc., USA.

Schmidt, W.H, L. Cogan and R. Houang (2011), “The role of opportunity to learn in teacher preparation: An international context”, *Journal of Teacher Education*, Vol. 62/2, pp. 138-153.

Schmidt, W.H. et al. (2008), “Opportunity to learn in the preparation of mathematics teachers: Its structure and how it varies across six countries”, *ZDM Mathematics Education*, Vol. 40, pp. 735-747.

Schmidt, W.H. et al. (2007), *The Preparation Gap: Teacher Education For Middle School Mathematics In Six Countries*, Michigan State University, East Lansing, MI.

Strong, M. (2005), “Teacher induction, mentoring, and retention. A summary of the research”, *The New Educator*, Vol. 1/3, pp. 181-198.

Toledo-Figuera, D., N. Révai and S. Guerriero (2017), “Teacher professionalism and knowledge in qualifications frameworks and professional standards”, in: Guerriero, S.(ed.) (2017), *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264270695-en>.

Vangrieken et al. (2015), “Teacher collaboration: A systematic review”, *Educational Research Review*, Vol. 15, pp. 17-40.

Watt, H.M.G and P.W. Richardson (2007), “Motivational Factors Influencing Teaching as a Career Choice: Development and Validation of the FIT-Choice Scale”, *The Journal of Experimental Education*, Vol. 75/3, pp. 167-202, DOI: <http://dx.doi.org/10.3200/JEXE.75.3.167-202>.

ANNEX

Box 1. Opportunities to learn about teaching diverse classrooms in the ITEL TKS

- differentiated instruction (e.g. individual assistance, internal differentiation, personalised instruction)
- student individual differences (e.g. prior knowledge, motivation, ability levels)
- identification of learning difficulties of students and interpretation of specialists' diagnosis (e.g. dyslexia, dysgraphia, attentional problems, etc.)
- identification of giftedness
- integration of pupils with special needs
- intercultural pedagogy and differences between pupils from different nationalities, cultures and social background
- differences between girls and boys and gender pedagogy
- methods and interventions for inclusion and inclusive pedagogies, including methods for preventing and dealing with discrimination and bullying based on gender, sexual orientation, cultural background, etc.

Table 1. Dimensions of opportunities to learn in the ITTEL TKS

Opportunities to Learn: main dimensions	Subscales	Samples (in grey if relevant)					
		Pre-service teacher candidates	In-service teachers	Teacher educators			
Pedagogical Content	OTL - Instructional Process						
	OTL - Learning Process						
	OTL - Assessment						
Quality of Opportunities to Learn	Quality of Instruction						
	Demands						
	Student Agency						
Teaching Practicum	Quantity of Experience						
	Scope of Experience						
	Professional Support						
Research Activities	Engaging with Research						
	Engaging in Research						
Professional Collaboration							
Teacher Educator characteristics	Teaching methods						
	Student Agency						

¹ TEDS-M is comparative study carried out by the International Association for the Evaluation of Educational Achievement (IEA), which focused on the preparation of primary and lower secondary mathematics teachers. It is an international large-scale assessment of future teachers with representative samples of 17 countries. The study aimed to measure future teachers' professional knowledge including their content knowledge, pedagogical content knowledge, and in some countries, general pedagogical knowledge (GPK) as a national option (König, Blömeke, Paine, Schmidt & Hsieh, 2011; König, 2014).

² The EMW-study assessed the GPK of future teachers in the three German-speaking countries: Germany, Austria and Switzerland.

³ It is important to underscore that whenever we use the terms "effect" or "predictive of", we do not imply a causal but rather a statistical effect.