Migrant Teachers' Self-Estimated Digital Competence: A Study Within Swedish Teacher Education

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An increasing number of migrant teachers with a foreign teaching degree enter Swedish teacher education to complement their studies to become eligible to teach in Swedish schools. Digital competence is one of the central skills required of teachers in today's digitized information society. Within teacher education few studies examine how migrant teachers estimate their ability and skills within digital competence. Hence, in the present study, migrant teachers' digital competence is investigated applying the framework of technology, pedagogy, and content knowledge (TPACK), the European Digital Competence Framework for Citizens (DigComp 2.1), and the Digital Competence of Educators framework (DigCompEdu). A convergent mixed-methods research design was used. The combined datasets consisted of a web survey, focus groups, individual interviews, and reflective texts, which were analyzed both quantitatively and qualitatively. The respondents' initial teacher education was obtained in 57 countries/regions. The findings highlight that migrant teachers' digital competence is diverse, scoring from both very low to high in TPACK, as well as in DigComp 2.1, from a foundation proficiency level to a highly specialized one. This result implies that further development to enhance migrant teachers' digital competence must be diversified.

Background

In Swedish teacher education, migrant teachers with a foreign teaching degree are a growing group of students for whom additional training is offered to become qualified as a teacher in Sweden. Thus, embedded cultural aspects – such as power relations, ways teaching is conducted, and questions related to epistemology – must become more transparent for both migrant teachers and teacher educators (Käck, Männikkö Barbutiu, & Fors, 2018b; Nguyen, Terlouw, & Pilot, 2006).

Preferably, teacher educators would have some knowledge about the teacher-to-be's cultural profile in order to enhance the learning potential of the student (Moloney & Saltmarsh, 2016). However, culture-sensitive pedagogy can be developed and used only when cultural factors are examined (Thomas, 1997). Furthermore, intercultural learning and understanding teaching and learning when interacting together must be prepared for, facilitated, and debriefed (Bennett, 2012).

Intercultural ways of teaching and learning, shown when digital technologies are used, can sometimes be perceived as unfamiliar by the students (Käck, Männikkö Barbutiu, & Fors, 2018a, 2018b; Käck et al., 2014). Chamberlin-Quinlisk (2013) asserted that digital technology itself transforms teachers' ideas about classroom practices, intercultural relationships, and online collaboration. This assertion was illustrated in Hannon and D'Netto's (2007) findings concerning online learning. They emphasized that cultural differences impact the students' satisfaction and engagement with the organizational, technological, and pedagogical components, suggesting the importance of constructing a culturally inclusive environment.

This cultural gap was also discovered by Zhu, Valcke, and Schellens (2009), who found that one of their research groups was more positive toward the online collaborative learning environment, although the other nationally based groups, nevertheless, changed in motivation and learning strategies toward a socioconstructivist learning approach, during and after the learning experience.

Because individuals' teaching is influenced by their belief systems, the integration and use of digital technology is perennially relevant (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Sadaf & Johnson, 2017). A substantial transformation in teachers' beliefs and attitudes takes place only after they see evidence of enhanced student learning (Guskey, 2002).

Swedish law and teacher education curriculum emphasizes digital competence and the ability to use digital technologies in a pedagogically appropriate way. In the Higher Education Ordinance, Annex 2 (2014:1096), a teacher-to-be must show digital competence, using digital aids confidently and critically in educational processes as well as considering the significant roles of different media and a digital environment in education.

In this study, the respondents are students in the government-mandated project, Further Education for Foreign Teachers (*Utländska Lärares Vidareutbildning* in Swedish), started in 2007, which offers additional training for people who have a foreign teaching degree and wish to become qualified as a teacher in Sweden. The Swedish government allocates resources for further training. The education is not mandatory to be certified, however, because the Swedish National Agency for Education, working together with the Swedish Council for Higher Education in the process of assessing foreign education, is responsible for the authorization of teachers and the issuing of diplomas of certification.

This process is complex, considering that the differentiation between the backgrounds of migrant teachers is expansive. For some migrant teachers, supplementation of their education is required. For others, compensatory strategies are available, such as adaptation periods, aptitude tests, or different types of supplementary training. The aim with further education is to give migrant teachers a corresponding Swedish degree, as well as a knowledge base, for working in a Swedish context. In order to be accepted for further training, migrant teachers must possess a diploma of education at the university level.

Additionally, because teachers must teach in Swedish, proficiency in the Swedish language must be equivalent to an upper secondary (senior high school) course. An individual study plan for 1–2 years is designed, including democratic values, pedagogy in various subjects, and in-depth studies in subject matters. Information about the Swedish school's organization, values, laws, grading system, and school placement are included.

Migrant teachers in Swedish teacher education are heterogeneous; there is a considerable variation in the use of digital technologies among them (Käck et al., 2018a). Few studies examine how migrant teachers estimate their ability and skills within digital competence in Swedish teacher education. However, in this article, migrant teachers' self-estimated and self-expressed digital competence is addressed and discussed with intercultural aspects in mind.

Theory and Frameworks

Definitions

Technology, pedagogy, and content knowledge (TPACK). The TPACK framework has its origin in the concept of pedagogical content knowledge (PCK). Shulman (1986) introduced PCK as a blend, an interplay, and an intersection between content and pedagogy because these concepts too often were treated as separate in teacher education. In order to teach successfully, both needed to be addressed at the same time. With this idea in mind, Mishra and Koehler (2006) described a theoretical framework that incorporated technology as an essential part. The TPACK framework consists of three main components of a learning environment and the intersection between them (Figure 1). Mishra and Koehler (2006) used TPACK for designing pedagogical strategies and as a lens for analysis when technology is used. In addition, they contended that real and effective integration of technology requires understanding the relationships between three main areas: technology, content, and pedagogical knowledge.
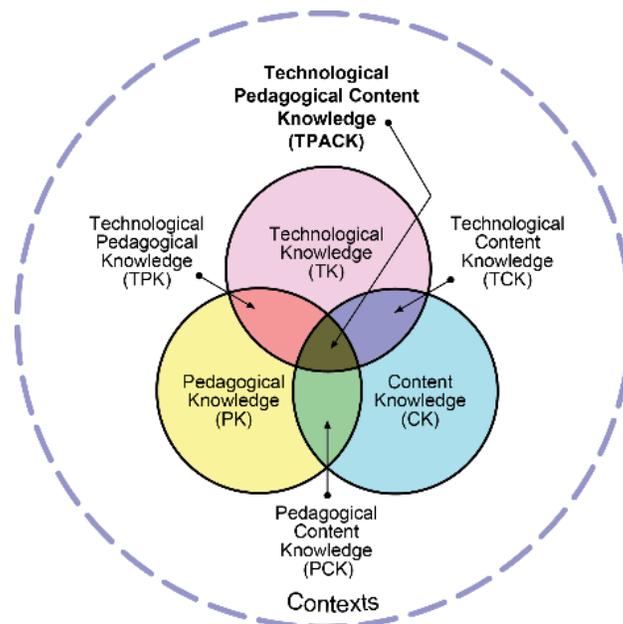
Figure 1. *The seven components of TPACK. Figure reproduced with permission of the publisher, © 2012 by tpack.org.*

In the TPACK framework, subcomponents are defined as follows:

1. Technological pedagogical knowledge (TPK), the ability to know what capabilities various technologies have in a teaching and learning context.
2. Technological content knowledge (TCK), knowing what kind of technology is suitable for the subject—the content.
3. Technological knowledge (TK), knowledge about the technology itself.
4. Pedagogical knowledge (PK), knowledge about teaching and learning methods— processes and practices in general.
5. Content knowledge (CK), the subject content that a teacher must learn.
6. Pedagogical content knowledge (PCK), teaching approaches suitable for specific subjects and learning objectives.
7. Technological pedagogical content knowledge, the intersection and interweaving of all the above subcomponents, also referred to as technology, pedagogy, and content knowledge, or TPACK.

In this current study, migrant teachers make self-estimations within the areas of technological knowledge (TK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK.

The European frameworks DigComp 2.1 and DigCompEdu. In the European Digital Competence Framework for Citizens, version DigComp 2.1 (Carretero, Vuorikari, & Punie, 2017), eight levels of proficiency connected to Bloom's revised taxonomy, including active verbs (Anderson et al., 2001) can be found, and a general role descriptor from DigCompEdu (Redecker, 2017; see Appendix A). This framework represents current European understanding and definitions of digital competence that citizens should acquire.

DigComp 2.1 provides a fine-grained-level description of digital competence aiming to support stakeholders in the implementation of digital competence. The Joint Research Centre of the European Commission has further developed the framework with a focus on educators, DigCompEdu, in order to support capacity building for the digital transformation of education and learning. The proficiency levels can be divided into cognitive domains/learning progress connected to active verbs; how autonomous a person can be when using digital technologies; and the complexity of tasks.

At the foundation of digital competence (Rankings 1–2), the cognitive domain is remembering, and people can solve simple tasks, with or without some guidance. At the intermediate level (Rankings 3–4), the cognitive domain is understanding, and a person can solve some routine, well-defined tasks, being independent. At an advanced level (Rankings 5–6), the cognitive domain is applying and evaluating, solving different tasks and problems, being able to guide others and furthermore adapting to others in a complex context. Last, at the highly specialized level (Rankings 7–8), creating is the cognitive domain, resolving complex problems with limited solutions or many interacting factors, integrating to contribute to the professional practice and guide others, and proposing new ideas and processes in the field (Carretero et al., 2017).

In contrast, DigComEdu (Redecker, 2017) used role descriptors to organize the digital competence stages at general proficiency levels. The newcomer and the explorer assimilate and develop new digital practices (remembering and understanding). The integrator and the expert apply, expand, and reflect over practices (applying and analyzing). Finally, the leader and the pioneer pass on their knowledge, critiquing existing practices and developing them (evaluating and creating). Those descriptors are intended to motivate educators to improve their achievements.

In this article, the term *digital technologies* is used, consistent with the European frameworks, as an umbrella term for all digital resources and devices.

Theory and frameworks in this study. TPACK (Mishra & Koehler, 2006), DigComp 2.1 (Carretero et al., 2017), and DigComEdu (Redecker, 2017) were used for the investigation of migrant teachers' digital competence. TPACK provides a holistic frame in order to analyze how migrant teachers estimated their knowledge in digital competence when technology, pedagogy, and content are combined. DigComp 2.1 was chosen to analyze migrant teachers' self-expressed level of digital competence. DigComEdu was chosen to discuss migrant teachers' competence stages.

If and how teachers use digital technologies are connected to their knowledge and competence within this area. The questionnaire in this study investigated the teachers' self-estimated knowledge (Schmidt et al., 2009) within the framework of TPACK. Something to reflect upon is what knowledge the respondents expressed having when they were asked to estimate. Is this essentially a respondents' self-confidence rather than knowledge in practice that is measured (Lawless & Pellegrino, 2007; Willermark, 2018)?

Further, respondents' unawareness of their incompetence or, on the other hand, underestimated/overestimated competence is also troublesome. Broad items lead to higher self-estimation than the rating of more detailed, specific stimuli. Individuals seem to have a general sense of strength and weaknesses, but not a detailed sense (Ackerman, Beier, & Bowen, 2002; Lawless & Pellegrino, 2007). Even more complex is self-estimation in an intercultural setting due to culturally embedded learning environments. Everyone will answer from the point-of-view of their teaching beliefs (Käck et al., 2018b).

TPACK has been criticized for not being useful due to insufficient definitions, even though it is used as a theoretical framework in a number of countries to specify what is required for teaching in a digital society (Willermark, 2018). TPACK is part of this study because it is a well-known theoretical framework for estimating technological pedagogical content knowledge. Lacking, however, is research in intercultural teacher groups, studying at teacher education programs in a new country (Chai, Koh, & Tsai, 2013; Voogt & Roblin, 2012; Wu, 2013).

The European frameworks DigComp 2.1 (Carretero et al., 2017) and DigCompEdu (Redecker, 2017) were used in this study to analyze migrant teachers' levels of proficiency in using digital technologies, connected to Bloom's revised taxonomy (Anderson et al., 2001). Of interest was discovering which level of digital competence migrant teachers expressed themselves as being: foundation, intermediate, advanced, or highly specialized. Furthermore, by using the general role descriptor from DigCompEdu (Redecker, 2017; see Appendix A), it was possible to analyze if migrant teachers were newcomers, integrators, leaders, or pioneers.

The Aim of the Study and Research Questions

This study aimed to investigate how migrant teachers participating in Swedish teacher education estimated their TPACK and analyzed their digital competence in relation to the European framework. The research questions were as follows:

1. How do migrant teachers estimate their TPACK?
2. How do migrant teachers express their digital competence?

Methods

Research Design

In order to achieve an increased understanding of migrant teachers' digital competence, a convergent mixed-methods design was used, including both quantitative and qualitative data. This gives the opportunity to corroborate and triangulate the data collections, results, and analyses, thereby gaining a deeper understanding from the materials (Creswell & Plano Clark, 2017).

Population

The web survey in the study targeted all 465 actively enrolled migrant teachers in the government-mandated project, Further Education for Foreign Teachers, and obtained responses from 228 (49%) of solicited teachers. An overview of the population can be seen in Appendix B. The call for participation in the qualitative part of the study was included in the web survey and in the email to all 465 migrant teachers. Out of this group, 34 respondents participated voluntarily in interviews: nine individual interviews and five focus groups. Furthermore, 15 migrant teachers submitted reflective texts.

The migrant teachers' former teacher education was conducted in 57 countries or regions. Six Swedish universities participated in the project for migrant teachers, but only four participated in this study. Two universities were unable to participate due to low numbers of migrant teachers or time issues. The participating universities are identified as University A, University B, University C, and University D due to promised confidentiality.

As can be seen in Appendix B, most of the respondents were female. Each of the Swedish universities is represented in the survey and the individual interviews. Although it was not possible to gather a focus group at University D, each of the other universities were represented with focus groups. The reflective texts were collected at University A.

In the web survey, 36 responding migrant teachers were between 25 and 31 years of age, 80 between 32 and 38 years of age, 56 between 39 and 45 years of age, and 50 were older than 45. Years of former teacher education ranged from 36 respondents having 2 years of education, 36 having 3–4 years of education, 96 having more than 5 years, and eight having graduate education.

In the area of specialization, the teachers could select more than one box. The data show that 129 of the teachers were educated as teachers in upper secondary school, 110 in secondary school, 79 in middle school, 51 in primary school, 18 in preschool, eight in special education, one at a recreation center, and 25 in other types of specialization (special subjects or teachers for adults). Subject areas including social science, nature science, language, mathematics, art, music, special education, preschool, gymnastics, sports and health, recreation centers, and others more country-specific are represented in the study.

In the qualitative data collections, within the area of specialization, the respondents were educated for working as teachers in upper secondary school, secondary school, middle school, primary school, preschool, and special education. Subject areas such as social science, nature science, special education, gymnastics, sports and health, language (English, French, Russian, etc.), literature, mathematics, art, music, computers and technology, psychology, and others more country-specific are represented in the study.

Ethics

According to the Swedish Research Council (2017), the main concepts of ethical concern are professional secrecy (it is not allowed to discuss individual respondents with unauthorized people), anonymizing or deidentifying respondents, and confidentiality. In this study, all of them were applied.

At the end of the web survey, the respondents could tick a box and enter their email, agreeing to be contacted for an interview. In order to ensure the respondents anonymizing and deidentifying the answers, this data was immediately separated from the data set before the analysis was conducted.

Data Collection

A mix of four data collection methods — Web survey, individual interviews, focus group interviews, and participants' reflective texts — was applied to provide complementary and richer material. Contact was made to the national director for the project and the administration at each university. Through the universities' administrations, the respondents' email addresses were sent to the first author, who was then able to send email to the migrant teachers. The web survey was sent through a system and contained information about the study on the first page. At the end of the survey, the teachers could tick a box, enter their email, and give permission to be contacted for an interview. The reflective texts were voluntarily sent through a learning management system or sent to the first author by email. All data collection, both quantitative and qualitative, covered the following themes: ways of thinking and practicing, digital competence, and teaching philosophy. In this article, migrant teachers' digital competence is explored.

Quantitative data. Information about the survey was disseminated in several ways (via management systems, letters, email, seminars, and lectures). The web survey was sent to the entire population of 465 migrant teachers, and of those, 228 answered. The survey consisted of an information page and four sections: (a) demography with nine items; (b) teaching philosophy with 23 items and one open-ended question; (c) ways of thinking and practicing in Swedish education that could be experienced as troublesome or alien, and three open-ended questions; and (d) digital competence with 32 items. The respondents could answer the web survey with any digital device, and they could stop whenever they wanted and continue at any time. In this article, the survey section considering digital competence was investigated.

Items in this study were chosen from the TPACK questionnaire by Schmidt et al. (2009). All of the items directly correspond to the number of items in this survey. Only the items corresponding to the T, technology, were chosen, due to the length of the survey, including other pedagogical parts. Among the items affiliated with T, some modifications were made. In the original survey, Items 30–33 and 43–46 were divided into subjects such as mathematics and social science, but in this study, "my subject/specialisation" was used instead. Items 40 and 56 were excluded because they related to courses and professors external to teacher education.

Qualitative data. A number of semistructured interviews were conducted, nine individual interviews and five focus group interviews with a total of 34 individuals who volunteered to be interviewed by giving their permission in the web survey. Interviews were conducted at the participants' universities in rooms familiar to them, lasted between 40 and 70 minutes, and were digitally audio recorded by the interviewer. The first author conducted all the interviews. The migrant teachers were instructed that there were no right

or wrong answers and that it was important to reveal their own experiences. They were also told that the interviewer would ask clarifying questions if necessary.

As an introduction to the interviews, the respondents were shown the thematic areas for the interview — ways of thinking and practicing, digital competence, and teaching philosophy. The focus group method was chosen for its appropriateness in capturing experiences the respondents could share and compare with each other. This interaction gave the opportunity to reveal data not revealed in the individual interviews (Cousin, 2008). However, the individual interviews provided more in-depth insights, and the migrant teachers could express themselves without others' reflections.

Thirty reflective texts were collected from 15 of the migrant teachers attending the course, To Be a Teacher in Sweden (22.5 credits), at University A because they had an assignment suitable for the theme in this data collection. As a course assignment, migrant teachers at University A were asked to reflect on their teacher role and teaching in comparison to their former teacher education and work as a teacher in their former country. The purpose of the assignment was to allow migrant teachers to formulate the experiences, understandings, and insights they might have developed during their study, reflecting over past and present views of teaching and learning. The texts were voluntarily sent through a learning management system or sent to the first author by email.

Data Analysis

The survey contributed background data about the migrant teachers (Appendix B). Open-ended questions and the TPACK questionnaire were part of the survey. The data were analyzed using SPSS version 24 and Microsoft Excel; further on, a descriptive analysis was conducted. The reliability was tested through Cronbach's alpha.

All of the interviews were digitally recorded and then transcribed verbatim in Swedish. The data from the open-ended survey questions and all of the other qualitative data were transferred into MAXQDA, a qualitative data analysis software, for further processing and conducting a content analysis. The qualitative data was read several times to get an overview and understanding of the material. A content analysis was conducted, and coded segments were grouped and labeled according to the levels of proficiency in DigComp 2.1 (Carretero et al., 2017). Furthermore, migrant teachers' digital competencies, according to the role descriptors in DigCompEdu (Redecker, 2017), were analyzed. The quotations were chosen based on their representativeness to the categories.

Results

Components of the Results

The results are divided into two main parts: (a) migrant teachers' self-estimated knowledge in TPACK and (b) migrant teachers' expressed digital competence. The first part consists of a quantitative portion, the results of the TPACK survey (Schmidt et al., 2009), which are shown in Table 1 and Figure 2. Moreover, a convergent mixed-methods table, containing qualitative quotations exemplifying the self-estimated TPK, TPC, TK, and TPACK is presented (Table 2). Part 2 shows the qualitative categorization of migrant teachers' expressed digital competence, in relation to the levels in DigComp 2.1 (Carretero et al., 2017) and the competence stages with role descriptors in DigCompEdu (Redecker, 2017).

Nonresponse Analysis

Overall, 49% (228) of the respondents answered the survey that was sent to each migrant teacher studying at the four teacher education institutions represented in the study (Appendix B). The individuals who answered the survey covered the entire spectrum of migrant teachers involved in the program concerning gender, age, subjects, specialization, and so forth, and therefore may be deemed representative.

Each of the respondents was an active student and could answer the survey, so natural nonresponse was not an issue in relation to not being able to answer because of serious illness, travels, and so forth. However, the survey was offered only in Swedish, which could have had an impact. Another issue might be related to migrant teachers' lack of interest in the subject of digital competence. Although the survey could be answered using mobile phones, computers, iPads, and so forth, it can be troublesome to use the devices and answer the questions, especially in a language that is not one's first language. Last, it was a long survey. Although the response rate has a risk of bias due to language difficulties and a lengthy digital survey, the qualitative methods complement and corroborate the results of the web survey.
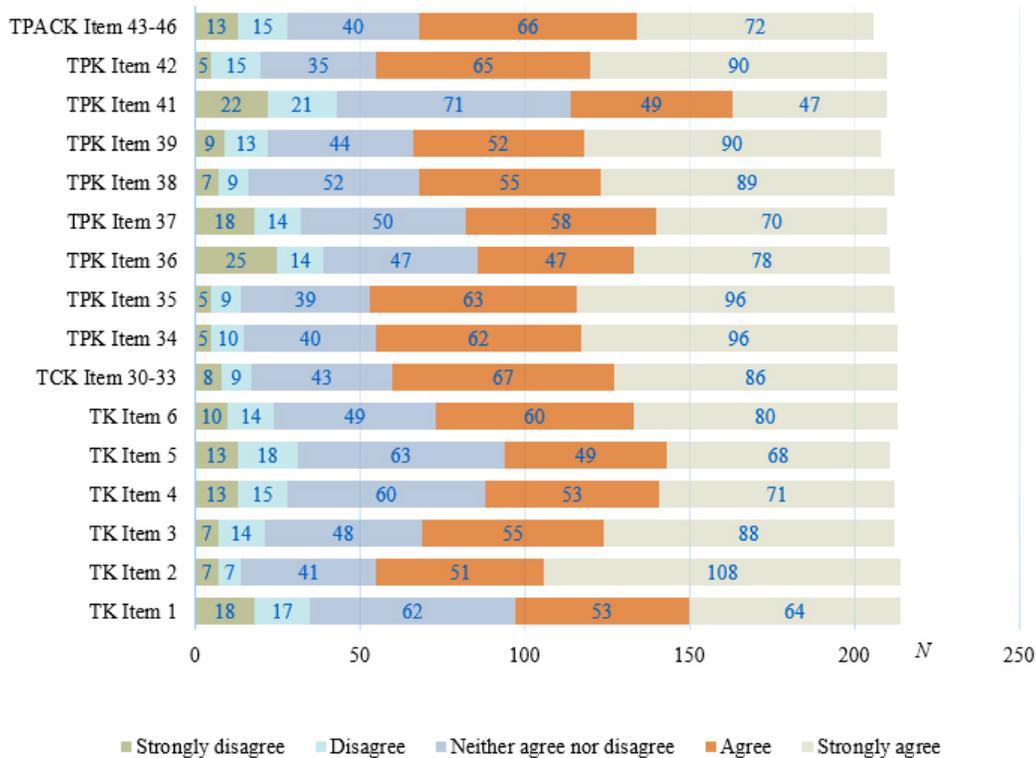
Migrant Teachers Self-Estimated Knowledge in TPACK

For each chosen section of the TPACK survey (Schmidt et al., 2009), the reliability was tested through Cronbach's alpha (a measure of internal consistency, how closely related a set of items are as a group) and an index was created (Table 1). The items in Table 1 are specified in Figure 2. As shown in Table 1, Cronbach's alpha ranged from 0.889 to 0.909. The reliability of the scores in Schmidt et al.'s (2009) survey ranged between 0.78 and 0.93 (TK 0.86 and TPK 0.93). The synthetic indexes in the present study representing technological pedagogical knowledge have the highest ranking (M = 3.886), followed by technological knowledge (M = 3.842). Because TCK Items 30–33 and TPACK Items 43–46 were reduced to just one item each, only the item number, respondents, and mean are shown. Moreover, the indexes of TPK and TK show almost the same standard deviation, meaning that migrant teachers present a high degree of individual differences within these areas.

Table 1
Synthetic Index for Each TPACK Subscale

Subscale	Item	*n* of items	Respondents	Cronbach's alpha	*SD*	*M*
TK	1–6	6	*n* = 202	0.889	0.911	3.842
TPK	34–42 (not 40)	8	*n* = 198	0.909	0.893	3.886
TCK	30–33	1	*n* = 213	-	-	4.000
TPACK	43–46	1	*n* = 206	-	-	3.820
Notes. n = number; *SD* = standard deviation; *M* = mean						

TPACK

Figure 2. *Results of the Schmidt et al. (2009) TPACK Survey.* N = *number of respondents.*

Findings show a diverse picture of migrant teachers' self-estimated TPACK. An overview of migrant teachers' answers is displayed in Table 2. In an overall picture, 14 to 43 of the respondents strongly disagreed or disagreed to having knowledge about different areas in digital competence. Furthermore, 35 to 71 respondents neither agreed nor disagreed to the item, expressing an uncertainty related to their digital competence. However, 96 to 159 respondents estimated themselves as very knowledgeable, having agreed or strongly agreed to the items.

Within TK, migrant teachers showed low scores in self-estimating solving technological problems (Item 1), playing around with technology (Item 4), and having knowledge about different technologies (Item 5). In the subscale of TPK, knowing what capabilities various technologies have in teaching and learning, they disagreed mostly regarding the statement "The teacher education program has caused them to think more deeply about how technology could influence the teaching approaches" (Item 36), thinking critically about how to use technology in the classroom (Item 37), and providing leadership in helping others to use technology in a pedagogical way (Item 41). Within the subscale of TPACK (Items 43–46), which was represented by just one question (knowing teaching lessons that appropriately combine the subject/specializations, technologies, and teaching approaches), 28 migrant teachers disagreed.

On the other side of the scale, within TK, they agree most to keeping up with (Item 3) and learning technology (Item 2), as well as having the skill to use it (Item 6). In TCK, knowing what technology is suitable for the content (Items 30–33), migrant teachers agree that they

know about technologies that can be used for understanding and being able to do the subject/specializations. Furthermore, in TPK, knowing what capabilities various technologies have in teaching and learning, migrant teachers agreed that they are able to choose technologies that enhance the teaching approaches for a lesson (Item 34), choosing technologies that enhance students' learning for a lesson (Item 35), and how to choose technologies enhancing the content for a lesson (Item 42). The knowledge of how to adapt the use of the technologies to different teaching activities (Item 38) and being able to select technologies to use in the classroom that enhance what and how they teach, as well as what students learn (Item 39), are also things they agreed on.

To make the quantitative results more transparent, quotations from the migrant teachers are included in Table 2. The quotations represent the opposite ends of the scale, "strongly disagree" to "strongly agree."

Table 2
Quotations Related to Migrant Teachers' Self-Estimation of TPK, TPC, TK and TPACK

Subscale in TPACK	Strongly Disagree/Disagree	Agree/Strongly Agree
TK - knowledge about the technology itself	"I am digital illiterate. They did not have the technology in my home country."	"I was a teacher in digital technologies in my country X."
TCK - knowing what technology is suitable for the content	"It [technology] is not needed, not in my profession as a language teacher."	"I have worked as a teacher for seven years and always integrated technology in all subjects."
TPK - knowing what capabilities various technologies have in teaching and learning	"During teacher education and when we worked as teachers, we only used literature in teaching and learning."	"My starting point is that the technology is a relevant pedagogical tool . . . for the learning process. It helps to deepen the pupils' knowledge."
TPACK - all aspects are considered, true technology integration	"We never used digital technologies [in country X] during teacher education nor when we worked as teachers."	"I wrote a book about the pedagogical use of digital technologies."

Notes. As part of the used mixed methods approach, qualitative quotations were added to exemplify the self-estimated TPK, TPC, TK and TPACK. The quotations represent the opposite ends of the scale, "strongly disagree" to "strongly agree."

Migrant Teachers' Expressed Digital Competence

The levels described in DigComp 2.1 (Carretero et al., 2017) and the competence stages with role descriptors in DigCompEdu (Redecker, 2017; see Appendix A) were used to categorize migrant teachers' self-expressed digital competence from the qualitative data collection and analysis. The categorization of 207 identified coded segments from the qualitative data collections related to the research question: How do migrant teachers express their digital competence?

The following account reports on the analysis of the four levels: (a) foundation level, (b) intermediate level, (c) advanced level, and (d) highly specialized level. In addition, the competence stages and role descriptors are newcomer, explorer, integrator, expert, leader, and pioneer. Appendix A gives an overview of the proficiency levels and descriptors, as well as active verbs. Quotations from participants are included throughout.

Level 1: Foundational digital competence (DigComp Ranking 1–2). At this level, the cognitive domain is remembering, and at the competence stages, the newcomer is identified. The newcomer assimilates new information and can perform simple tasks with some guidance. "During the last placement period, I prepared a PowerPoint and put some questions on the learning management system . . . however, I got help from my placement supervisor." Even though there are newcomers that are aware of the potential in using digital technologies, the findings showed a split awareness.

Some migrant teachers labeled themselves as having little digital competence, or never have used digital technologies, but are highly aware that this is something fundamental in the information society. Those migrant teachers express that since students and teachers use digital technologies, it is crucial for them to be able to use them as well. "Digital technologies are important in Swedish education, and teachers feel disabled without it."

Some participants described themselves as being digitally illiterate and unaware of the importance. "It [digital technologies] is not needed, not in my work as a teacher in language [and other subjects as art, music, mathematics]."

Other reasons for not using digital technologies reflected the teachers' former educational systems where digital technologies were unimportant — technical infrastructure was lacking, diversity in society with a gap between rich and poor or city and countryside, war, and so forth. "We did not have the possibility to use digital technologies; we lacked the infrastructure ... no computers, no electricity, no Internet, sometimes no food ....All of this is taken for granted in Sweden." In particular cases, the infrastructure was there, but parts of the digital technologies were forbidden to use in education. "In [country X], students have a bad situation ... parts of the Internet and social media were forbidden ... students cannot have contact with others."

Not all newcomers are positive toward the use of digital technologies in Sweden. Some of them said that it is overrated and time consuming for teachers or it takes too much of a place in education. Some of these teachers were critical of giving computers to all students, saying it does not solve all problems:

> Since I come from a country where digital technologies are never used [in education] ... I am shocked when teachers [in Sweden] have a computer .... Moreover, four students get computers and start to learn .... I believe this is so negative for students!

Overall, for newcomers, digital technologies were a challenge to overcome. They wanted to develop their digital practices and expressed a need for more guidance and further education. Even so, in this group there were migrant teachers with low digital competence but used to the ways of teaching and learning conducted in Sweden. Others struggled with both the digital technologies and teaching in a collaborative, self-directed way, feeling lost.

Level 2: Intermediate digital competence (DigComp Ranking 3–4).Migrant teachers expressing digital competence at an intermediate level can understand, explore, and independently solve some problems according to their needs. The demand from Swedish society is a push factor to use digital technologies. It is a must to be digitally competent in modern information society, since everything is so technical. "Today the society demands that we adapt to [the use of digital technologies]."

Migrant teachers as explorers have a growing insight and awareness that digital technology is something beneficial, relevant, and needed in the future. "As a teacher, you must know things that surround your students."Former pedagogical methods, such as using literature as the only resource, was mentioned. Hence, selecting digital technologies is viewed as something good but new, not having had the opportunity to use it in their former education. "If you can use the learning management system, then it is something good …. I had some problems in the beginning …. However, it is a good way to get information, communicate with teachers, and upload your assignments."

They expressed some interest in digital technologies, considering it as something useful. "You can save time, find information." One can write and put one's documents online, work in groups and give feedback to each other, use forums to discuss and communicate, and so forth. Other digital technologies mentioned were presentations, sending email, writing texts, looking at websites, surfing the Internet to find pictures, and hardware such as laptops and smartphones.

However, findings show that at the intermediate level, the focus was still on the migrant teachers individually, even though they could encourage others to use digital technology. Although they expressed some digital competence, the emphasis is more on the teacher's competence, not deep reflections over strategies for student learning, or how to choose the proper digital technologies. "You can go there and get a lot of ideas to give to the students. That is so good …. However, I do not understand how to use it in teaching and learning."

This lack of understanding can be connected both to former teaching methods, using literature, and to new ways of teaching and learning that are not transparent for them, if they come, for example, from a strong teacher-centered education. If so, the focus on the teacher is more common, not on creating strategies for the students.

Some of these migrant teachers expressed a lack of self-confidence about using digital technologies. They said that they tried to discover which apps could be used, but no one helps them do that; they must figure it out themselves."I try to learn how to create examinations …. Moreover, I try to understand how it is used." They desired more support and knowledge about how to use digital technologies d, as well as understanding how different digital technologies work and how to use them in their teaching, since it was not always familiar in the Swedish context, and last, discussing solutions.

> I need to develop [my digital competence], I do not feel confident with the digital technologies .,.. However, it facilitates [teaching and learning] …. The students are so far before us, and therefore I feel that I need it.

Level 3: Advanced digital competence (DigComp Ranking 5–6). At an advanced level, where the cognitive domain is applying and evaluating, teachers will be able to solve different tasks and problems, guide others, and adapt to others in a complex context. As an expert or integrator, they described a development from a focus on how to use digital technologies toward a more pedagogical focus. Being updated in one's subject was seen as necessary, which makes digital technologies an enabler. "In [my subjects] … new things happen every day. You have to give your students new information. You cannot give them old stuff, it has to be updated, and you have to use it."More integrated use of digital technologies in all subjects, programs for books, and so forth, were mentioned as a domain of expanding and integrating their practices.

Furthermore, findings showed that digital technologies were seen as support in the process of teaching and learning, not as being the focus of it. The expert and integrator shared that digital technologies can be teaching aids that motivate students, helping them to gain more in-depth knowledge and having the role of intermediary between the student, teacher, and the information that is sought after. "Sometimes, during a lesson, I am not sure [of something in the subject], then a student search for it and say the answer …. Moreover, I thought: What is that?"

Examples of digital technologies mentioned by the migrant teachers that are used for administration, communication, information and learning included apps, social media, blogs, streaming services, programming of small games, texting videos, digital learning objects, digital whiteboards and projectors, and laptops for all students. Sharing and collaborating via video conference systems and learning management systems and working in projects with other schools via e-learning were also mentioned. They also expressed evaluation as important. "As a teacher, you must be able to evaluate what digital technologies that are appropriate in the teaching and learning."

Migrant teachers said they applied digital technologies for pedagogical documentation, activities and learning, guiding others in a complex context (making the learning transparent for both students and parents), and facilitating assessment, feedback, and examination (using a learning management system). Another reason to use digital technologies was to analyze, scaffold, and solve tasks and learning problems for students with special needs in the classroom cognitively and emotionally, to give them the feeling of being more secure, more knowledgeable, and able to get help from others, and last, that something is interesting in the school for them. Migrant teachers who expressed this level of digital competence had often used digital technologies in their former country, and the teaching and learning methods used in Sweden and described in the European frameworks were not unfamiliar.

Being digitally competent was seen as something modern and a must in the modern teacher role. One teacher stated, "I see [digital competence] as one of the fundamental competencies everyone must have today … as important as to be able to read and write. If you can read and write but know nothing about computers, you cannot accomplish anything." Another surmised, "You cannot survive if you are not competent within digital technologies."

As further development, they wanted to meet persons who are interested in digital technologies connected to their subject. Hence, some of the migrant teachers said that their digital competence development in Sweden had been positive. "I developed fast when I came to Sweden …. I could not use a computer …. Then I started to understand; there are teaching methods [digital technologies] … there is a thought behind it." Migrant teachers who expressed these kinds of thoughts did not have much experience when they began the Swedish teacher education program but were interested and motivated to expand their

knowledge about digital technologies. However, they often had to find out the teaching and learning methods behind it by themselves.

Level 4: Highly specialized digital competence (DigComp Ranking 7–8). At a highly specialized level, migrant teachers are considered pioneers and leaders. With evaluating and creating as the cognitive domain, they are able to create and resolve complex problems, and they can contribute to professional practice – expressing a well-developed awareness of the use of digital technologies.

They compared the integration of digital technologies and their development in their former education to the Swedish one, expressing that it was used more in their former education and schools. "I thought Sweden was far behind us [former country] when it comes to digital technologies." Moreover,

> They have missed something [in Sweden] .... Some schools have invested in one-to-one, and they know what they are doing. Others have just bought a lot of digital technologies, and the teachers do not know what to do with them.

Having the competence to evaluate and use appropriate digital technologies in different pedagogical settings is seen as necessary, an opportunity to vary teaching using multimodality to enhance learning. "You know, involve more impressions, see, hear, read etc. .... I am a little bit in love with digital technologies."

They were interested and active in developing their own and their students' digital competence. They "show the concrete [via digital technologies] to understand [in a more abstract way]." "You have to develop from concepts, concretize them, show, do, then develop to the other cognitive steps." Education should connect to the real world, which can be enhanced via digital technologies. "The world tends to get smaller ... possibilities with contacts and connect with people from different countries ... contribute to good lessons .... It is the digital technologies that give so many opportunities."

Creativity is mentioned as a motivational factor for using digital technologies, both for the teachers and their students; for example, programming, digital creating, and turning games into learning. "There is so much to do .... The students love to work with digital technologies, sketch maps, compare with each other .... The programs are fantastic to work with." "Superfast to find music from the whole world ... then use digital technologies to create music."

The pioneer and leader pass on their knowledge, critiquing existing practices and developing new ones. Examples of migrant teachers expressing their digital competence at this level are as follows: "It is good to use digital technologies, but that process needs more regulations, so the focus is on the goals of the school." They were also aware of and able to discuss the risks of using digital technologies, such as plagiarism, bullying, and pictures that are spread via social media. Furthermore, they saw themselves as guides to help their students to use digital technology. "Digital methods helps the teachers to allure students with ways to learn, to reach the goals."

Although expressing an impressive level of use ("I always use digital technologies in my teaching"), they wanted more knowledge. Discussing further development, they expressed the importance of meeting persons who are interested in digital technologies connected to their subjects, researchers and people that inspire new innovative ideas. "I was thirsty, dry, but I came to the water [the digital technologies], and it is extremely interesting for me .... I did not have the possibility earlier as I have today."

Migrant teachers at this level want to experiment with digital technologies and continuously develop teaching and learning. Because the frameworks stress how teaching and learning progress, from remembering to creating, migrant teachers who had high digital competence but did not share this view, were not found at the highest levels. Digital competence is related to required abilities and skill within a certain context. At the highly specialized level were migrant teachers that found themselves comfortable both with digital technologies and the stated ways of teaching and learning.

Discussion

Migrant teachers are not a homogenous group; their education and experience with the use of digital technologies varies widely. The content and pedagogical use of digital technologies must be transparent as well, given that the way teaching is understood and conducted depends on embedded cultural aspects that can sometimes be experienced as unfamiliar (Nguyen et al., 2006; see also Chamberlin-Quinlisk, 2013; Hannon & D'Netto, 2007; Käck et al., 2018a, 2018b; Käck et al., 2014; Zhu et al., 2009).

In this study, migrant teachers' digital competence was investigated through the lenses of TPACK (Mishra & Koehler, 2006), DigComp 2.1 (Carretero et al., 2017) and DigComEdu (Redecker, 2017). An overview of the survey results showed a diverse spectrum: 14 to 43 respondents estimated their technological pedagogical content knowledge as low, 35 to 71 respondents neither agreed nor disagreed with the items, while 96 to 159 respondents estimated themselves to be very knowledgeable, having answered "agree" or "strongly agree" to the TPACK items.

Items that migrant teachers disagreed with most were as follows: (a) solving technological problems, (b) the teacher education program has caused them to think more deeply about how technology could influence teaching approaches, and (c) providing leadership in helping others to use technology in a pedagogical way.

Analysis of the qualitative data in relation to DigComp 2.1 (Carretero et al., 2017) and DigCompEdu (Redecker, 2017), showed a similar picture (Appendix A). These frameworks made the findings of migrant teachers' expressed digital competence more transparent. In both frameworks, the newcomer expressed more of a need for further guided development at a foundation level.

In DigCompEdu (Redecker, 2017), the newcomer was described as positive toward digital technology, but in this study, other categories were found as well. Some participants were aware and motivated and want more knowledge. Others were unaware and even reluctant to use digital technologies.

Teachers in each of these categories need different types of further development. The first one is already motivated and needs basic skills; the second needs help to see the affordances of digital practice. In order to be convinced of its benefits, the reluctant need to see good examples of how digital technologies enhance student learning. According to Guskey (2002), change in teachers' beliefs and attitudes occurs only when seeing evidence of enhanced learning. The explorer, at an intermediate level, is already on her way to understand, explore, and try out digital technologies. Connecting digital technology and pedagogical practice is the challenge — how to use different digital technologies in teaching and discuss different solutions.

At the other end of the scale, the pioneer, leader, integrator, and expert were identified. TPACK items with the most "agree" answers were as follows: (a) keeping up with learning

technology, (b) knowing how to choose technologies in order to enhance the approaches for a lesson, (c) content of a lesson, and (d) the student's learning. They were already using digital technologies in pedagogical practice and asked for further development at a more complex level. This attitude will be beneficial for future work, an innovative practice when working in schools. Swedish teacher education and schools can benefit from migrant teachers' contribution of experience and knowledge at advanced and highly specialized levels.

Why did migrant teachers, the 35 to 71 respondents who neither agreed nor disagreed to the items in TPACK, answer the way they did? Was it the easiest way to answer, staying in between? Alternatively, did they see themselves as having only *some* digital competence? This leads us into the discussion about self-estimation and if it was self-confidence rather than knowledge that was measured (Lawless & Pellegrino, 2007; Willermark, 2018).

The TPACK questionnaire (Schmidt et al., 2009) uses items that are less specific. Broader items tend to lead to higher self-estimation (Ackerman et al., 2002; Lawless & Pellegrino, 2007), which could explain why the respondents of the survey predominantly answered toward the more knowledgeable side.

Another aspect that can impact the results is the connection to individual ways of thinking and practicing in teaching, originating in intercultural teaching beliefs. Respondents answered broad questions based on their teaching philosophy, which can be different from an epistemological point of view (Käck et al., 2018b). There are different answers to being able to teach with digital technologies. For some, it can be the ability to present in different ways, from a teacher-centered view. For others, it can be teaching in an innovative classroom using student-centered collaborative strategies. Teaching beliefs connected to the integration of digital technologies are worth considering when further development is constructed (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Sadaf & Johnson, 2017).

The quantitative research instruments did not allow answers to these questions, but used together with the qualitative methods this issue can be solved. Identifying the migrant teacher's pedagogical background via interviews is helpful (Käck et al., 2018a; Käck et al., 2014), or as Moloney and Saltmarsh (2016) expressed it, know the teacher-to-be's cultural profile in order to activate and enhance the learning potential of students' prior knowledge.

Identifying cultural factors (Thomas, 1997) is essential so that intercultural learning can be prepared for, facilitated, and debriefed (Bennett, 2012). In order to gather more information, mixed methods were used in this study, which also enhanced validity and reliability. By combining different collection methods and considering the results and analyses, one can glean a more holistic view of the subject. In this study, the qualitative data collection supported and explained the answers in the survey.

Teaching and learning are conducted in a variety of ways in different countries, which has implications for the use of digital technologies as well. In an intercultural setting, some migrant teachers may have a wealth of knowledge in using digital technologies and be familiar with the teaching and learning context in Sweden. On the other hand, others may be digitally illiterate, with an epistemological foundation that is far from the Swedish one. Of course, some migrant teachers fall between these two contraries, making the issue more complex.

Migrant teachers may be familiar with the ways of teaching and learning, but be digital illiterate, or they may be digitally competent but not know anything about the ways of

teaching and learning in the country they have arrived in. Therefore, as a teacher educator, it is of utmost importance to know one's student cohort.

To enhance digital competence among all groups, further education that relates the use of digital technologies to epistemological issues must be addressed. Implications of the results are as follows:

1. All teachers need to have a digital competence level of at least 5–7, being able to guide and teach others, and being an expert or leader, because Sweden is a highly digitized society.
2. Differentiation of further digital development is needed, due to the vast diversity in former competence;
3. More transparent and better-explained teaching and learning methods are needed when digital technologies are trained.

In order to understand how further education in digital competence can be developed for migrant teachers, research is needed about how epistemological foundations impact digital education in an intercultural context. Other studies of interest may examine how, what, and why teaching about digital technologies is performed in different ways. Are digital technologies taught in an inclusive, intercultural way, or are they taught in a way that takes for granted that everyone would approve?

Conclusion

This study investigated migrant teachers' digital competence. The results show a diverse picture of digital competence and the way of thinking and practicing among migrant teachers. Some struggled at a basic level; others were more experienced and could analyze the use of digital technologies from different perspectives. Intercultural aspects, such as how teaching and learning are practiced and understood, must be addressed during the further development of digital competence.

When analyzing the data in relation to the frameworks, it becomes obvious that teachers, in general, need to have at least an advanced level of digital competence, which means that they can enhance students' digital competence development and learn with digital technologies, as well as contribute to professional practice. Hence, teacher educators can develop a culture-sensitive pedagogy, having intercultural knowledge about migrant teachers and connecting it to the use of digital technologies.

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Appendix A

Main Keywords at the Proficiency Levels and Active Verbs in DigComp 2.1 (Carretero et al., 2017, pp. 13, 19–43) and General Role Descriptors From DigCompEdu (Redecker, 2017)

Levels	DigComp 2.1	Complexity of tasks	Autonomy	Learning progress + active verbs	DigCompEdu Role descriptor	
Foundation	1	Simple tasks	With guidance	Remembering Active verbs: identify, find, detect, follow, recognise, select simple, choose	Explorer/Newcomer	Awareness Assimilate new information
Foundation	2	Simple tasks	Autonomy and with guidance where needed		Explorer/Newcomer	Develop basic pedagogical digital practices
Intermediate	3	Well-defined and routine tasks, and straightforward problems	On my own	Understanding Active verbs: explain, indicate, perform, illustrate, describe, select, organize, discuss, clarify, express	Explorer/Newcomer	Exploring digital technologies
Intermediate	4	Tasks, and well-defined and non-routine problems	Independent and according to my needs		Explorer/Newcomer	Encourages learners to use digital technologies
Advanced	5	Different tasks and problems	Guiding others	Applying/Analyzing Active verbs: respond, use, apply, operate, show, propose, carry out, share	Expert/Integrator	Experiment in a variety of contexts, select with purpose Expand, integrate and reflect on practices
Advanced	6	Most appropriate tasks	Able to adapt to others in a complex context	Evaluating Active verbs: assess, adapt, explain, vary, change, discover	Pioneer/Leader	Uses a range of digital technologies Enhance pedagogical practices
Highly specialised	7	Resolve complex problems with limited solutions	Integrate to contribute to the professional practice and to guide others	Creating Active verbs: create, integrate, contribute, guide, propose	Pioneer/Leader	Critique and develop existing practice Experiment with highly innovative and complex digital technologies
Highly specialised	8	Resolve complex problems with many interacting factors	Propose new ideas and processes to the field		Pioneer/Leader	

Appendix B
Summary of Data Collection Activities

Data collection	Former teacher education in:
Survey *N* = 228 (out of 465) 49%: 12% male and 88% female University A: *n* = 180 of 380 (47%) University B: *n* = 18 of 30 (60%) University C: *n* = 9 of 15 (60%) University D: *n* = 21 of 40 (52.5%)	Algeria, Argentina, Azerbaijan, Bangladesh, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, Central America, Chile, China, Costa Rica, Cuba, Egypt, Ethiopia, Finland, Georgia, Germany, Greece, Hungary, India, Iraq, Iran, Japan, Jordan, Kenya, Kosovo, Kurdistan, Latvia, Lebanon, Lithuania, Mongolia, Netherlands, Nicaragua, Pakistan, Palestine, Philippines, Poland, Romania, Russia, Serbia, Spain, South Africa, Syria, Taiwan, Thailand, Turkey, Ukraine, USA, Uzbekistan, Yugoslavia, Zambia
Individual interviews *N* = 9: male *n* = 3 and female *n* = 6 University A: *n* = 2 University B: *n* = 4 University C: *n* = 1 University D: *n* = 2	Hungary, Latvia, Canada, Nicaragua, Palestine, Philippines, Russia, Serbia, South Africa
Focus groups *N* = 5 groups; *N* = 25 teachers male *n* = 4 and female *n* = 21 University A: 3 groups University B: 1 group University C: 1 group	Belarus, Bulgaria, China, Estonia, Hungary, India, Iraq, Iran, Latvia, Mongolia, Peru, Poland, Philippines, Russia, Ukraine
Reflective texts (30 texts) *N* = 15 teachers male *n* = 3 and female *n* = 12 University A (all)	Balkans, Bangladesh, China, Germany, Hungary, Iraq, Iran, Kurdistan, Latvia, Lebanon, Serbia, Ukraine
In sum	**Continents:** Asia *n* = 107 Europe (not Sweden) *n* = 95 South America *n* = 12 Africa *n* = 8 North America *n* = 3

Notes. Value *N* = Total number of respondents, value *n* = number of respondents in a case.