# Exploring Finnish EFL Teachers' Perceived Technological Pedagogical Content Knowledge (TPACK) following Emergency Remote Teaching: A Quantitative Approach

Maija Lamminpää
MA Thesis
English, Degree Programme for Language Specialists
School of Languages and Translation Studies
Faculty of Humanities
University of Turku
April 2021

*The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.*

UNIVERSITY OF TURKU

School of Languages and Translation Studies / Faculty of Humanities

LAMMINPÄÄ, MAIJA: Exploring Finnish EFL Teachers' Perceived Technological Pedagogical Content Knowledge (TPACK) following Emergency Remote Teaching: A Quantitative Approach
MA Thesis, 55 pp., 25 app. pp.
English, Degree Programme for Language Specialists
April 2021

– – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – – –

In Finland, the current National Core Curriculum (NCC) greatly emphasizes developing students' skills in information and communication technologies (ICT). Mastering such skills is therefore expected from teachers, as well. However, research has indicated that there is variation in the extent to which technology is integrated into teaching, partially because of differences in teacher skills (Tanhua-Piiroinen et al. 2020, 38–39).

Technological Pedagogical Content Knowledge (TPACK) is a framework for understanding and describing what teachers need to know in order to effectively teach with technology. The purpose of this thesis is to explore the current level of perceived TPACK among Finnish teachers of English as a foreign language (EFL). The level of TPACK is studied in general and with respect to teachers of different age groups and with varying amounts of teaching experience. In addition, the thesis investigates the impact that Finnish EFL teachers' feel the period of emergency remote teaching (ERT), caused by the COVID-19 pandemic in spring 2020, had on their ICT skills.

A total of 69 Finnish EFL teachers participated in the study, which utilized the TPACK instrument developed for EFL teachers by Baser, Kopcha & Ozden (2016). The data were gathered through an online survey and analyzed with the statistical analysis software SPSS.

The results indicate that Finnish EFL teachers' perceived level of knowledge is consistently high in all TPACK domains. Due to the small variance across participants, only minor differences could be detected in the scores for some TPACK domains when examined with relation to age and teaching experience. Furthermore, the majority of the participants reported ERT had improved their ICT skills, while a fifth of the participants already had such high skills that they were not affected by ERT.

Although the findings implicate a high level of TPACK among Finnish EFL teachers, the results cannot be generalized to the entire population. In order to obtain more precise and generalizable results, it is suggested that a TPACK instrument more suitable for the Finnish context is developed, and that the sample of participants is selected through sampling methods that ensure more representativeness of the entire population. Thus, the results provide valuable information for future TPACK research in Finland.

Keywords: language teaching, technology, English as a foreign language, emergency remote teaching, TPACK, ICT

# Table of Contents

## List of Figures



## List of Tables



## List of Abbreviations

| | |
|---|---|
| **EFL** | English as a foreign language |
| **ICT** | Information and communication technology |
| **NCC** | National Core Curriculum |
| **ERT** | Emergency Remote Teaching |
| **TPACK** | Technological Pedagogical Content Knowledge |
| **TK** | Technological Knowledge |
| **PK** | Pedagogical Knowledge |
| **CK** | Content Knowledge |
| **PCK** | Pedagogical Content Knowledge |
| **TCK** | Technological Content Knowledge |
| **TPK** | Technological Pedagogical Knowledge |

# 1 Introduction

Teaching a language, as well as any other subject, requires much more than just knowledge of the matters that are taught. Not only must teachers be experts on the subject they teach – they must also be familiar with the pedagogically best ways to support their students on their journey of learning. In addition to knowing the subject and its didactics, 21st century teachers are more and more often also expected to integrate technology into their teaching. This is the case in several OECD countries, including Finland, where the importance of teachers' technological knowledge and skills has grown significantly since the introduction of the current National Core Curriculum for Basic Education (NCC), in effect since 2016 (Tanhua-Piiroinen et al. 2019, 12–13; van der Vlies 2020). The increased emphasis on developing students' skills in information and communications technology (ICT) has naturally entailed new challenges for Finnish teachers (Finnish National Agency of Education n.d.).

Although teachers in Finland are now formally obligated to use technology in teaching, there is variation in the extent to which this decree is implemented (Tanhua-Piiroinen et al. 2020, 38–39). Not only do schools have varying access to technological devices, but how extensively technology is implemented on teaching depends greatly on individual teachers' attitudes and skills (Camilleri & Camilleri 2016, 66; Tanhua-Piiroinen et al. 2020, 45). As research has indicated, merely introducing technology to the educational progress does not guarantee success in the matter, because being able to effectively teach with technology requires a broad range of knowledge and skills (Niess 2017, 1–2; Mishra & Koehler 2006, 1018–1019).

One of the few theories specifically interested in the types of knowledge teachers need for successful technology integration is the framework of Technological Pedagogical Content Knowledge (TPACK). Although originally independent of the subject matter, the TPACK model has later been adapted to better capture knowledge in specific subject domains, including English as a foreign language (EFL). Having already been investigated especially in Asian and Middle Eastern countries (Tseng et al. 2020, 1), a considerable gap still exists in TPACK research in the Finnish context. Further supported by the ever-increasing significance of technology in schools as well as in society, Finnish EFL teachers' TPACK provides an important and yet unexplored topic for this research. Especially since the introduction of the

current NCC, studying Finnish EFL teachers' TPACK sheds new light on how the teachers perceive their ability to implement the NCC into language teaching in practice.

The use of technology in teaching has recently been in the spotlight even globally, when the COVID-19 pandemic caused schools to shut down and switch to emergency remote teaching (ERT) in spring 2020. Having to completely resort to technology-dependent distance instruction created new challenges for both teachers and students (Ferri, Grifoni & Guzzo 2020, 4), but appears also to have enhanced teachers' abilities with technology (Ahtiainen et al. 2020, 17), further increasing the significance of the topic of this study.

In this thesis, I examine Finnish EFL teachers' (n=69) perceived Technological Pedagogical Content Knowledge (TPACK). The quantitative data were gathered through a self-report questionnaire and analyzed using the statistical analysis program SPSS. The aim is to investigate the current level of Finnish EFL teachers' TPACK and compare possible differences between teachers of different ages and with varying amounts of teaching experience. Finally, the effect of the period of emergency remote teaching in spring 2020 on Finnish EFL teachers' perceived ICT skills is also investigated. Thus, the research questions are as follows:

1 What is the level of Finnish EFL teachers' perceived Technological Pedagogical Content Knowledge (TPACK)?
2 What kind of differences can be observed in the levels of perceived TPACK knowledge depending on teachers' age or amount of teaching experience?
3 How do Finnish EFL teachers think the period of emergency remote teaching due to the COVID-19 pandemic in spring 2020 affected their ICT skills and thereby their perceived TPACK?

In linguistic research, a difference is often made between English as a foreign language (EFL) and English as a second language (ESL). Aware of the differences as well as the complexities of the definitions, this thesis considers English a foreign language in Finland because it is not a native or official language in the country.

This thesis consists of seven sections. First, the theoretical background, TPACK, is discussed in Section 2, while the context of this study is considered in Section 3. Section 4, in turn, presents the material used in this study as well as the methods applied in data collection and analysis. The research findings are analyzed and contrasted with previous research in Section 5, and their implications discussed in Section 6. The limitations of the study are also considered in that section before giving suggestions for future research. Finally, concluding reflections are provided in Section 7.

# 2 Technological Pedagogical Content Knowledge

This section discusses the theoretical framework used in this study to investigate teachers' knowledge of teaching with technology. I will begin by defining some key technology-related concepts before introducing the TPACK framework and its knowledge components, especially illustrating them from the perspective of EFL teaching. I will also discuss some of the ways in which teachers' TPACK can be measured as well as the problematic aspects of the framework. Finally, the section will end with an overview of research that has been conducted on EFL teachers' perceived TPACK.

## 2.1 Defining Technology

When we talk about technology, we usually mean computers, phones, and other digital technologies. However, as Koehler and Mishra (2008, 5) point out, technology can also be defined more broadly as "the tools created by human knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants". In this sense, technology can refer to either an individual tool or technique (such as computer technology or the internet), or more broadly to a combination of all tools, techniques, and knowledge (ibid.). For example, educational technology would consist of the sum of techniques, tools, and knowledge applicable to education, without distinguishing between older, analogue technologies (e.g. blackboard and pencil) and newer, digital technologies (e.g. computer and smart phone) (ibid.).

Although Koehler and Mishra (ibid.) originally explained that the concept of technology in the TPACK model included both analogue and digital technologies, most TPACK research has focused particularly on digital technologies and their integration into teaching. This is perhaps due to the fact that traditional technologies, such as pencils and chalkboards, have already long ago been integrated into teaching, whereas digital technologies are a relatively new, constantly developing concept whose role in teaching is extremely difficult to chart as a whole. However, still remaining central to the concept of technology in the TPACK model is the understanding of the specific affordances and constraints that particular technologies have – an ability that teachers need to possess in order to be able to determine

whether applying a certain technology into teaching specific content improves students' learning or not (Koehler & Mishra 2008, 5).

In line with earlier TPACK research, the term *technology* in this thesis refers to digital technologies and, more specifically, to information and communications technology (ICT) (Ling Koh, Chai & Tay 2014, 20; Angeli, Valanides & Christodoulou 2016, 14). The terms technology and ICT are used interchangeably in this study. Because the TPACK framework is especially concerned with the content-specific knowledge of pedagogically effective technology use, the term *technological skills* is used to describe the mere ability to use technology without consideration of the aspects related to content or pedagogy, as opposed to the more comprehensive knowledge of technology use, described as *TPACK*.

## 2.2 The TPACK Framework

As the role of technology in the classroom has gradually grown more and more significant, it has also become evident that mere technological skills do not necessarily guarantee the effective integration of technology in teaching (Koehler & Mishra 2005, 132). Instead, due to the complexity of the situations that occur in the classroom when technology is integrated into teaching and learning, the knowledge that teachers need for such integration is anything but simple to define (Koehler & Mishra 2009, 61; Angeli, Valanides & Christodoulou 2016, 11). To address this complexity, the framework of Technological Pedagogical Content Knowledge (TPACK) was developed, introduced as "a body of knowledge of what teachers need to know to teach with technology" (Angeli, Valanides & Christodoulou 2016, 11). As the first, long-awaited unifying conceptual framework in the field of educational technology, the TPACK model has become widely popular in research in the 21st century (Angeli, Valanides & Christodoulou 2016, 13; Archambault & Barnett 2010, 1656).

The interest in TPACK can roughly be divided into two perspectives. On the one hand, the TPACK model itself and the nature of its knowledge has been of researchers' interest (Angeli, Valanides & Christodoulou 2016, 21–22; Niess 2017, 10): it has been explored (e.g. Archambault & Barnett 2010; Chai, Ling Koh & Tsai 2016; Tseng et al. 2020), validated (e.g. Shinas et al. 2013; Scherer, Tondeur & Siddiq, 2017), and criticized (e.g. Brantley-Dias & Ertmer 2013; Saubern et al. 2020). On the other hand, the TPACK model and its different

versions have been applied to studying and thus understanding (both pre-service and in-service) teachers' knowledge and skills in integrating technology into teaching, which is also the perspective taken in this study.

The roots of the TPACK framework lie in the concept of Pedagogical Content Knowledge (PCK), a framework introduced by Lee Schulman in the late 1980s. The idea of PCK was to introduce a more coherent way to describe the relationship between teachers' knowledge of a particular subject-matter (content) and their knowledge of teaching that content (pedagogy) (Archambault & Barnett 2010, 1657). This unique combination of knowledge in a specific field of study, along with the ability to tailor teaching in such a way that it leads to learning, is what differentiates a professional teacher from a common educator (Schulman 1987, 8). As PCK became a widely popular theory in education over the following decade, the early 21st century saw the theory being expanded to the framework of Technological Pedagogical Content Knowledge.

Introduced in 2005 by Matthew J. Koehler and Punya Mishra, the TPACK model was built on Schulman's concept of PCK as a way to measure teachers' knowledge of content, pedagogy, and technology, and especially the interactions among and between these types of knowledge (Koehler & Mishra 2009, 62; Kabakci Yurdakul et al. 2012, 965). Essential to the TPACK model is the perspective that teachers' knowledge about technology is important but not separate from the contexts of teaching (Koehler & Mishra 2005, 132; Hew & Brush 2007, 238). A high level of TPACK is therefore required for effective teaching with technology and characterized by the competencies included in the TPACK model (Koehler & Mishra 2009, 66–67).

The components of the TPACK framework, also known as knowledge domains, are illustrated in Figure 1. The types of knowledge mentioned in the previous paragraph – content, pedagogy, and technology – are pictured as the large circles that overlap each other. The overlapping areas between the circles present the interactions between and among these core types of knowledge and are called Pedagogical Content Knowledge (PCK – the precursor of the TPACK framework), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK) (Koehler & Mishra 2009, 63). At the center of the framework is the concept of Technological Pedagogical Content Knowledge (TPACK), which consists of

all the other types of knowledge and the interactions between them. The knowledge components will be further elaborated in the following section.

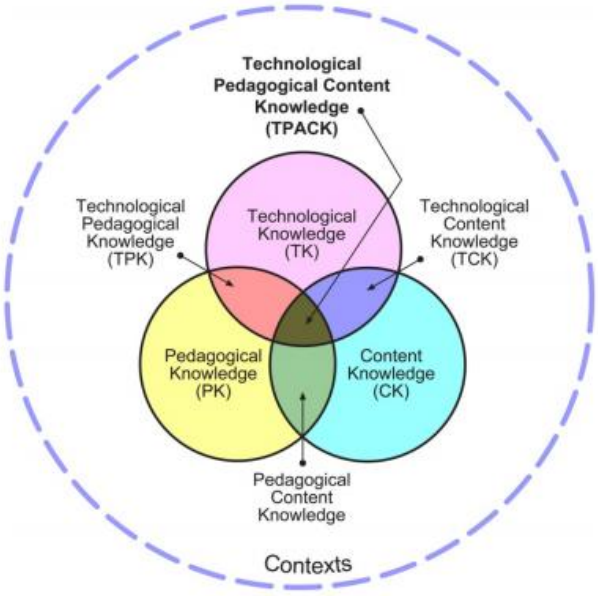



**Figure 1** The TPACK framework and its knowledge components (Koehler & Mishra 2009, 63)

### 2.2.1 Knowledge Components in the TPACK Model

In the TPACK framework, *Content Knowledge (CK)* refers to knowledge about the subject matter that is taught; in EFL teaching, this naturally means knowledge of the English language. On the one hand, the CK of an EFL teacher can be described as consisting of "language proficiency and communication skills, language awareness, and knowledge of culture" (Bostancıoğlu & Handley 2018, 579–580). On the other hand, Rahimi & Pourshahbaz (2019, 134–135) define this language proficiency as competence in linguistics, grammar, discourse, communication strategies, and sociolinguistics. Finnish EFL teachers' content knowledge is generally viewed as high since all teachers are required to complete a master's degree with at least 60 ECTS in the English language (5 § in the Decree on Qualification Requirements for Teaching Staff).

*Pedagogical Knowledge (PK)*, then, means knowledge about the processes and practices of teaching and learning – involving all teaching regardless of the subject-matter (Mishra & Koehler 2006, 1026). Building upon an understanding of developmental, social, and cognitive theories of learning, a teacher with a high level of pedagogical knowledge

understands how students construct knowledge, can plan lessons and manage a classroom, assess students' learning, as well as adjust their teaching to fit the target group of learners (Mishra & Koehler 2006, 1026–1027; Koehler & Mishra 2009, 64). Because PK is not a content-specific domain, its definition is the same for English teachers as it is for, for example, science teachers. All Finnish subject teachers must complete 60 ECTS in educational science, which is much more than many other countries require (5 § in the Decree on Qualification Requirements for Teaching Staff).

Like PK, *Technological Knowledge (TK)* is independent of the content being taught and therefore universal for different disciplines. However, compared to the previous two types of core knowledge, CK and PK, the definition of TK is more versatile. Originally, Koehler & Mishra (2005, 133) defined it as knowledge of both standard technologies, such as books, chalk, and blackboard, as well as modern technologies, including computers, internet, and digital videos – something similar to the traditional notion of computer literacy. However, due to the constant advancements in technology and thus the versatile nature of TK, its definition has tilted towards possessing a certain attitude towards technology rather than a command of specific devices (Koehler & Mishra 2009, 64). Therefore, TK could perhaps better be described as a deeper, more fundamental understanding and command of information technology for information processing, communication, and problem solving - something similar to the notion of Fluency or Information Technology (FITness) (National Research Council 1999; Koehler & Mishra 2009, 64). In this sense, there is no end state for TK – instead, it is developmental in character, constantly evolving when a teacher is in a "generative, open-ended interaction with technology" (Koehler & Mishra 2009, 64).

As mentioned in Section 2.2, the construct of *Pedagogical Content Knowledge (PCK)* in the TPACK framework is consistent with Schulman's (1987) ideas, even though the notion has been extended and criticized since its introduction (for example, see McEwan & Bull 1991; van Driel, Verloop, & De Vos 1998). Essentially, Koehler & Mishra (2009, 64) describe PCK as including the processes of interpreting the subject-matter, transforming it into different representations, and adapting and customizing the teaching materials to possible alternative conceptions and students' prior knowledge. PCK in the EFL TPACK relies heavily on the knowledge of theories of Second Language Acquisition (SLA) (Bostancıoğlu & Handley 2018, 580). This knowledge of how students learn languages, as well as knowledge of the

aspects that students find problematic in learning English, is essential for the EFL teacher to be able to transform, adapt, and customize the subject-matter into teachable representations (Rahimi & Pourshahbaz 2019, 136).

*Technological Content Knowledge (TCK)* refers to knowledge of the ways in which technology and content affect each other, including understanding the constraints and affordances that technology creates for representing different content (Mishra & Koehler 2006, 1028). In the EFL TPACK, TCK refers to a teacher's understanding of how technology can be utilized in representing language knowledge and culture and understanding what kinds of opportunities technology can provide for language use in English learning environments (Bostancıoğlu & Handley 2018, 580). Essentially, this refers to a somewhat limited knowledge of computer-assisted language learning (CALL) in the sense that technology can be used in learning a language, but the teacher is not necessarily familiar with the pedagogically best ways to do so (Rahimi & Pourshahbaz 2019, 141). The role of CALL in the EFL TPACK will be discussed more precisely in Section 2.3.

*Technological Pedagogical Knowledge (TPK)*, then, is the understanding of how technology and teaching affect one another, and how teaching and learning can be enhanced or limited by using certain technologies (Koehler & Mishra 2009, 65–66). A high level of TPK contributes to the teacher's ability to choose the technologies that best fit his/her pedagogical choices (Kyllönen 2020, 34).

Finally, *Technological Pedagogical Content Knowledge (TPACK)* combines all previously described kinds of knowledge, manifesting itself when a teacher understands and effectively negotiates the relationships between them (Koehler & Mishra 2005, 134). More specifically, technology integration is not just about adding technology to the existing knowledge of teaching and content – rather, introducing new technology brings about representations of new constructs, thus necessitating an understanding of the dynamic, transactional relationship between different components of knowledge (ibid.). Consequently, it is argued that TPACK is an understanding that underlies all "truly meaningful and skilled teaching with technology" (Koehler & Mishra 2009, 66).

In EFL teaching, TPACK involves, for example, a) developing technology-enriched environments for language learning, b) being part of digital language learning communities, c) providing students with access to resources for digital language learning, and d) modeling

intercultural communication with the help of technology (Bostancıoğlu & Handley 2018, 581). These aspects are also deemed important by Baser, Kopcha & Ozden (2016, 751) who developed the TPACK survey used in this study. Thus, this description also applies to the way TPACK is perceived in this thesis.

### 2.2.3 The Problematics of TPACK

Although the TPACK framework has become widely popular in research, it is still a relatively young approach which has its problematic aspects. As Koehler, Shin & Mishra (2012, 17) explain, frameworks must always be examined within the real world, where it is essential to develop instruments and measures that are both in line with the theory and measure what they are intended to measure. I will now briefly discuss the main ways in which teachers' TPACK can be studied before proceeding to consider some of the main issues with the TPACK framework as raised by previous research. These relate mainly to the (un)clarity of the knowledge domains and the little influence some claim the theory has had on teaching in practice.

Although both qualitative and quantitative methods have been applied in TPACK research, the most common way to assess teachers' TPACK has been different self-assessment instruments, usually in the form of a questionnaire (e.g. Schmidt et al. 2009; Scott 2021; EFL TPACK: Baser, Kopcha & Ozden 2016; Bostancıoğlu & Handley 2018). The questionnaires have traditionally consisted of statements related to the use of technology in teaching, which the participants then react to by rating the degree to which they agree to each statement (Koehler, Shin & Mishra 2012, 20). The responses are subsequently transformed into scores, indicating the level of TPACK among the subjects.

In addition to self-assessment instruments, some studies have also used methods such as performance assessment, observation, or student assessment (Koehler, Shin & Mishra 2012; Fathi & Yousefifard 2019), or a combination of methods, which naturally provides a different or more versatile perspective of teachers' TPACK (Willermark 2018, 339). In previous research, the TPACK based on self-report is sometimes called *perceived* TPACK to distinguish it from the knowledge that is measured using other, external methods. This elaboration is also used in this study to indicate that the results are solely based on the participants' own reporting.

In their study on validating the TPACK framework, Archambault & Barnett (2010, 1661) concluded that the TPACK model might appear effective in research communities but that it actually provides less benefit to educators in practice. In other words, they argue that measuring knowledge in each TPACK domain is "complicated and convoluted", possibly because the domains are not actually separate but rather intertwined (ibid.). This is supported by, for example, Scherer, Tondeur & Shiddiq (2017, 15), whose empirical results indicated that pre-service teachers' perceived levels of TCK, TPK, and TPACK could not be distinguished from another, with TK being the only unique technology-related domain. The framework received similar criticism from Brantley-Dias & Ertmer (2013, 123) who argued that the model in its current form is both too complex and too vague, calling for a simplification of the framework.

Despite these suggestions, the framework has not been simplified, still consisting of seven domains. The issues mentioned above have nonetheless been addressed in more recent research with promising results. For example, an overview of TPACK research conducted by Chai, Ling Koh & Tsai in 2016 concluded that researchers appear to mostly be able to identify all seven TPACK factors with varying levels of specificity for the areas of technology, pedagogy, and content (Chai, Ling Koh & Tsai 2016, 97). This also applies to the TPACK research focused specifically on language teaching (Tseng et al. 2020, 18–19). Therefore, the lack of construct validation could be addressed by considering the evidence that has accumulated throughout the first decade of TPACK research regarding the structure and generalizability of the framework. In addition, as Willermark (2018, 338–339) concludes, every approach to identify and measure teachers' TPACK has its advantages and disadvantages, which could be compensated for by combining multiple methods. Thus, she predicts a mixed-method approach will be an emerging trend in TPACK research in the future (ibid.).

In addition to the complexity of the knowledge domains, the TPACK framework has been criticized for its limited applications to understanding teachers' knowledge of technology integration in practice. For example, Angeli, Valanides & Christodoulou (2016, 24–25) and Saubern et al. (2020, 1) argue that since so much of research on TPACK has focused on investigating the framework itself, the focus should now move towards finding ways to utilize the framework in practice. More specifically, Saubern et al. (2020, 6) explain

that the instruments created for measuring TPACK should be validated "primarily in relation to the extent to which they represent the knowledge required to use technology effectively for teaching and learning rather than their fidelity to the TPACK diagram". The importance of applying the theory to practice is supported by, for example, Brantley-Dias & Ertmer (2013, 123), who conclude that "constructs about teacher knowledge, such as TPACK, must move the field of teacher education forward in ways that ensure teachers are able to meet the challenges of millennial classrooms and 21st century student learning".

## 2.3 EFL Teachers' TPACK

Although the subject-specific notion of an EFL TPACK is quite new as a concept, it is not new as an idea. In fact, observations similar to the central idea of the TPACK framework have also been made in the context of technology integration in language learning. For example, Lawrence (2018, 142) discusses the fact that current language teaching pedagogy cannot merely be 'computerized' – instead, new ways of teaching must be created when new technologies are introduced. Hence, the biggest challenge in technology integration is not the technology itself but the changes in methodology that it brings about (Lawrence 2018, 142; Rahimi & Pourshahbaz 2019, 34).

From the perspective of technology in language learning, the concept of Computer Assisted Language Learning, also known as CALL, is usually the first theory that springs to a linguist's mind. Emerging as a field of study in the 1980s, CALL can broadly be defined as an "academic field that explores the role of information and communication technologies in language learning and teaching" (Davies 2009, 265). Although the theories of TPACK and CALL are both associated with using technology in the classroom, there is still a significant difference between the two: while CALL refers to technology in language learning and teaching, the language teachers' TPACK refers to the knowledge that is required of teachers in order to effectively integrate this technology into their teaching. In other words, TPACK refers to the knowledge of teaching with technology rather than the technology itself. The EFL TPACK, in particular, attempts to specify the knowledge that teachers need to possess in order to effectively use CALL in their teaching (Rahimi & Pourshahbaz 2019, 145). Thus, the two theories can be considered complementary rather than exclusionary by nature.

Previous research has indicated that the TPACK of EFL teachers tends be above average on each scale being used. For example in Taiwan, Wu & Wang (2015) studied primary school EFL teachers' TPACK (n=22), concluding that the participating teachers' knowledge in each TPACK domain was significantly above the average, with the mean scores being approximately 5 out of 7 for each domain. Thus, the teachers appeared to be highly confident in their knowledge, especially in PK (M=5.99, SD=0.72), while the scores for TK were the lowest (M=5.01, SD=0.96). Similarly in the Taiwanese setting, Hsu (2016) conducted a study on the effects of teachers' TPACK on adopting methods of mobile-assisted language learning (MALL). On a scale of 1 to 7, the participants (n=158) received mean scores close to 5.00 for the domains of TK, CK, PK, PCK, and TCK (SD varying from 1.01 to 1.38), and mean scores close to 6.00 for the domains of TPK and TPACK (SD=1.78 and 1.39). The results indicated that the level of knowledge on the TPACK components was high and deemed critical to adopting MALL.

Further, Alharbi (2020) studied Saudi EFL teachers' knowledge of the TPACK components CK, PK, and TK. The results indicated that the knowledge of EFL teachers in Madinah city (n=199) was relatively high in all three components, with mean scores varying from 3.45 to 3.79 out of 5 (SD approximately 0.50 in all domains). Statistically significant differences were also found between gender and TPACK, namely indicating that male participants had a higher CK, whereas females had higher scores in both PK and TK. However, no statistical significance was found between the participants' amount of teaching experience and their TPACK.

Similar results were achieved in Turkey, where Kozikoğlu & Babacan (2019) studied EFL teachers' TPACK and attitudes towards technology. The participants (n=721), who were from 81 different provinces in Turkey, were found to have a similar level of TPACK and a positive attitude towards using technology, scoring a mean of 3.46 out of 5 in TPACK knowledge and thus being close to the level measured in by Alharbi (2020) in Saudi Arabia. Further in accordance with the Saudi results, the study concluded that the teachers' TPACK and attitudes towards technology were not significantly different depending on their professional experience as a teacher.

Somewhat lower scores were received in Indonesia, where Mukminin, Habibi & Fridiyanto (2020) investigated the TPACK of EFL teachers in Indonesian senior high schools (n=375). The findings showed that the participating teachers had a higher knowledge in the non-technological domains of content and pedagogy than in the domains related to technology. The mean scores for PK, CK, and PCK were 3.49, 3.54 and 3.36 out of 5 respectively, while the mean scores for TCK and TPACK were as low as 2.13 and 2.32 respectively (SD varied from 0.86 to 1.15 across domains). The majority of the participants explained they had had somewhat limited exposure to technology, which was considered a factor in explaining the relatively low results.

In Iran, Nazari et al. (2019) studied novice and experienced English teachers' perceived TPACK (n=427). In the study, novice was defined as ranging from still in training to up to two years of teaching experience, and experienced teachers were defined as having been in the profession for at least four to five years. Contrary to the above-mentioned studies, the quantitative results indicated that experienced teachers in Tehran had significantly higher scores in PK and PCK, whereas novice teachers in the same city scored higher in TK, TCK, TPK, and TPACK. The results for each knowledge domain, presented as sums of the scores for interrelated items, showed more variance than in other countries even in general, as both novice and experienced teacher received almost full scores in CK (M=44.9/45; SD=0.72 and 0.25), but only 8.2 and 7.0 out of 36 in the domain of TPACK (SD=2.7 and 1.6).

Having presented the theoretical framework applied in this study as well as some of the implications of previous research on EFL teachers' TPACK, I will now proceed to discuss the context of technology use in the Finnish education system.

# 3 Technology in Finnish Schools

This section provides the context of this study by discussing the role that technology plays in Finnish schools. I will begin by briefly presenting the education system in the country, after which I will proceed to discuss the current National Core Curriculum (NCC) for Basic Education as well as its decrees on the use of technology in the classroom. Second, I will consider how the NCC has been implemented into teaching in practice with regard teachers' technological skills and TPACK. Finally, the period of emergency remote teaching (ERT) during the COVID-19 pandemic in spring 2020 will be discussed from the Finnish perspective.

As in many other developed countries, the education system is considered one of the cornerstones of the Finnish society (Ministry of Education and Culture n.d.-b). The Finnish system consists of six stages: early childhood education and care, pre-primary education, nine-year basic education (also called comprehensive school), upper secondary education, higher education, and adult education (ibid.). Comprehensive school is often further divided into elementary school (grades 1–6) and lower secondary school (grades 7–9). All children are subject to compulsory education until the age of 16 but the execution of said education can vary; home-schooling is also possible. However, most children attend pre-primary and basic education and over 80 percent of students also continue to take a degree in at least upper secondary education (Education Statistics Finland n.d.).

Starting from 2021, compulsory education in Finland will be extended to 18 years, which means that in addition to basic education, upper secondary education will also be free of charge (Ministry of Education and Culture n.d.-a; n.d.-b). Comprehensive schools are maintained by municipalities and other education providers, and less than two per cent of comprehensive school pupils attend schools that are run by a private party or the state (ibid.). Thus, the educational equality in Finland is considered very high compared to many other OECD countries (OECD 2018, 45). However, the level of equality has somewhat decreased in recent years (Hautamäki & Thuneberg 2019, 90–91; Kalenius 2020, 250–252), which the recent heavy emphasis on technology has also been accused of accelerating (Uusisalmi 2017, 18).

Apart from language immersion programs, language teaching starts in elementary school (Finnish National Board of Education 2016, 136). Since the school year 2019–2020, all children start learning a foreign language at the age of seven (Finnish National Agency for Education 2019). Studying a foreign language is compulsory throughout the education system, from basic to higher education. For most students, the language that is started with and studied the longest is English: in 2017, English was studied by 90.1 percent of students in grade 3, and by 99.4 percent of students in grades 7-9 (SUKOL n.d.). In addition, 98.0 percent of students who graduated from general upper secondary education in the same year had completed the A-level syllabus for English as a foreign language (ibid.).

The contents and aims of comprehensive education in Finland are defined in the National Core Curriculum for Basic Education, which provides a common direction for education in the country (Antikainen et al. 2013, 196). The core curriculum defines which knowledge and skills are deemed important to be learned by all citizens, how they are taught, and what kind of goals are set for teaching (ibid.). In addition to basic education, there are NCCs for other levels of education. However, because basic education is attended by the majority of Finns, the NCC for Basic Education is the curriculum with the broadest impact on Finnish people's lives. Therefore, the discussion will focus solely on that curriculum.

Starting with the NCC that was published in 1994, the aspect of utilizing technology in teaching has gradually become more and more important. The significance information and communication technology (ICT) in the current NCC will now be discussed in more detail.

## 3.1 ICT in the Current NCC for Basic Education

In effect since 2016, the current NCC emphasizes the importance of using ICT in schools considerably more than its predecessors. In the current curriculum, ICT skills are part of a new objective called *transversal competence* (fi. laaja-alainen osaaminen), which refers to a competence that consists of knowledge, skills, values, attitudes, and will, and is the goal of all teaching throughout basic education (Finnish National Agency for Education 2016, 21). The seven fields of transversal competence are Thinking and learning to learn; Cultural competence, interaction, and self-expression; Taking care of oneself and managing daily life; Multiliteracy; ICT Competence; Working life competence and entrepreneurship; and

Participation, involvement and building a sustainable future (Finnish National Agency for Education 2016, 21–25). Although ICT competence in itself forms one of the fields, using ICT is mentioned in the descriptions of four other fields, as well, further emphasizing its significance (ibid.).

In order for the goal of transversal competence to be met and for ICT competence to be built, the use of technology is encouraged throughout the NCC. For example, in the section defining common working methods for entire basic education, it is stated that "[d]iverse and appropriate use of information and communication technology expands the pupils' possibilities for developing their working approaches and networking skills. This builds their capabilities for independent, interactive and critical acquisition and processing of information and its creative production" (Finnish National Agency for Education 2016, 32). The NCC also instructs that information and communication technology should be used in cooperation between home and school and in assessing learning (Finnish National Agency for Education 2016, 36, 48). In addition, remote teaching is encouraged (Finnish National Agency for Education 2016, 39).

Using ICT is also frequently mentioned in the details regarding each subject, as is the case for English and other foreign languages. Throughout comprehensive education, ICT is described in the tasks of the subject of foreign languages as providing "a natural opportunity for implementing language instruction based on authentic situations and the pupils' communication needs" (Finnish National Agency for Education 2016, 136, 236, 375). For grades 3–6, ICT competence is specifically mentioned as one of the goals of foreign language learning. In order to achieve a good grade (8 on a scale from 4 to 10) in a foreign language, a student in grades 3-6 should be able to "practice his or her language proficiency confidently, also using ICT" (Finnish National Agency for Education 2016, 237).

As can be noticed from the examples provided above, the ways in which technology and ICT competence are mentioned in the NCC are rather vague. Although ICT skills are set as one of the main goals of the entire basic education, the NCC does not give specific instructions as to how technology use should be carried out in practice. This vagueness has resulted in versatile ways in which the goals of transversal competence are met in practice (Tanhua-Piiroinen et al. 2020, 38–39). Next, research results on teachers' skills, which play a significant role in the implementation of the NCC in practice, will be considered.

## 3.2 Teachers' Knowledge and Skills

Since the introduction of the current NCC, Finnish teachers' experiences with technology have been primarily positive (Tanhua-Piiroinen et al. 2020, 54). This section provides further insight into teachers' actual knowledge of teaching with technology, which is directly linked to their use of ICT as prescribed by the current NCC.

Because the NCC has been in effect for less than five years, a substantial amount of research has not yet been conducted on its effects, including the use of technology. *Comprehensive Schools in the Digital Age* and its sequel *Comprehensive Schools in the Digital Age II*, reports commissioned by the Finnish Government and the Finnish Ministry of Education and published by Tanhua-Piiroinen et al. in 2019 and 2020, give recent and comprehensive accounts on the state of technology use in Finnish schools and form the basis for discussion in the following two sections. Due to the limited amount of research having been conducted on Finnish in-service teachers' TPACK, research results on teachers' technological skills are considered instead.

Even though the current NCC has not been in effect for long, Finnish teachers' technological skills have already improved significantly (Tanhua-Piiroinen et al. 2019, 47). Interestingly, though, the use of technology has not increased to the same extent (Tanhua-Piiroinen et al. 2020, 20). Approximately a half of the participating teachers in 2019 (n=2,132) rate their ICT skills as *basic*, while about a fifth report their ICT skills as *developed, pedagogical skills* (Tanhua-Piiroinen et al. 2020, 63–64). The number of teachers who consider their ICT skills *insufficient* is roughly the same as the number of those who consider themselves as *versatile users of ICT* (10% and 12% respectively) (ibid.). Finally, a mere 4 percent consider themselves as *experts on ICT* (ibid.). Overall, teachers seem to assess their technological skills as at least adequate. A more comprehensive review of teachers' skills could possibly be achieved by complementing these self-evaluations with, for example, observations of teachers' use of technology during lessons.

Finnish teachers' technological skills seem to correlate more strongly with their age than with their gender (Korkeakoski 2019, 66–67; Tanhua-Piiroinen et al. 2020, 70). In *Comprehensive Schools in the Digital Age II*, a fourth (26 percent) of teachers aged over 60, and a fifth (19%) of those aged 50–59 considered their ICT skills as insufficient (Tanhua-

Piiroinen et al. 2020, 64). The number of younger teachers considering their skills insufficient was mere 2 percent among teachers both under 30 and 30–39 and 7 percent among teachers aged 40-49 (ibid.). Correspondingly, teachers who reported their ICT skills as developed, pedagogical ICT skills, or considered themselves as versatile users of ICT were mostly under 40 years old (ibid.). Korkeakoski's thesis (2019, 66–67) aligns with these results; teachers under 46 years considered their technological skills higher than those who were older. Younger teachers having higher confidence in their ICT skills could be due to ICT being included already in their teacher training, while older generations of teachers have had to rely on in-service training.

The question of in-service training, or lack thereof, is indeed often mentioned in research on teachers' technological skills. Although several Finnish schools have found tutoring programs and peer support helpful in technology integration, specific in-service training has also been organized and is further expected by the majority of Finnish teachers (Korkeakoski 2019, 40; Tanhua-Piiroinen et al. 2020, 83–84). Teachers wish for training in all areas of technology, but especially in the basic use of different devices and in creating digital content (ibid.). The support provided by in-service training not only adds to teachers' technological skills – it encourages them to try out different devices and methods and gives them confidence in their abilities (Tanhua-Piiroinen et al. 2020, 40). According to Korkeakoski (2019, 41–42), teachers develop their ICT skills by researching and practicing independently or by participating in different groups online. This is supported by the fact that teachers' active use of digital media and other digital services in their everyday lives seems to correlate positively with their technological skills and their use of technology (Tanhua-Piiroinen et al. 2020, 40).

## 3.3 Emergency Remote Teaching during the COVID-19 Pandemic

Teachers' technological skills — both in Finland as well as worldwide — were truly put to the test in the spring of 2020 when the COVID-19 pandemic caused schools globally to shut down and switch to remote instruction. As opposed to regular online instruction, which is based on planned course designs created beforehand, ERT is a method of online teaching which evolves as a response to a crisis or disaster (Hodges et al. 2020). Having to resort to completely technology-dependent distance instruction naturally creates technological and pedagogical challenges for teachers and students alike (Ferri, Grifoni & Guzzo 2020, 4), but also provides an opportunity for completely new experiences with technology-based instruction.

Even though extensive research has not yet been published on the experiences and effects of ERT, preliminary results indicate that Finnish teachers appear to have managed with technology rather well under the exceptional circumstances (Ahtiainen et al. 2020; Finnish Education Evaluation Centre 2020; University of Turku 2020). Loima (2020, 6) even describes the Finnish education system's actions a success, as meaningful learning could be continued uninterrupted throughout the new and confusing situation.

Ahtiainen et al. (2020) collected extensive data on Finnish teachers' experiences with ERT in May and June 2020 (n=5,361). According to the preliminary results, the vast majority of teachers (94%) estimated that their technological skills had improved at least somewhat, and 66 percent of the participants further believed the experiences of ERT would impact the way they teach in the future (Ahtiainen et al. 2020, 17). The positive experiences are supported by studies conducted on a smaller scale: a case study on a Finnish high school (n=9–15) reported that teachers had acquired new technological platforms rather quickly (Niemi & Kousa 2020, 352), and a qualitative study on Finnish primary teachers' experiences (n=8) concluded that the increase in technological skills was most often mentioned by the participants as the greatest advantage of ERT (Taipale 2021, 41).

Having discussed the theoretical framework as well as the context of this thesis, I will now proceed to discuss the material and methods used in this study.

# 4 Data and Methods

In this section, the material and methods of the present study are introduced. First, the goal of the thesis as well as the research questions are revisited. Following that, the participants of the study and the data collection methods are introduced. Finally, the methods that were used to analyze the data are discussed.

The purpose of this thesis is to investigate Finnish EFL teachers' knowledge of teaching with technology by studying their technological pedagogical content knowledge (TPACK). In addition, the study explores how EFL teachers in Finland think the period of emergency remote teaching in spring 2020, caused by the COVID-19 pandemic, affected their ICT skills. Investigating the level of EFL teachers' TPACK is especially important since the current NCC heavily emphasizes the importance of ICT skills and since previous research has indicated that there is variance in the extent to which this objective is met in practice. In addition, research on EFL teachers' TPACK provides valuable information for Finnish language teacher education and in-service teacher training by indicating what teachers already feel they master well and what they think could still be improved.

The research questions of the present study are as follows:

1 What is the level of Finnish EFL teachers' perceived Technological Pedagogical Content Knowledge (TPACK)?
2 What kind of differences can be observed in the levels of perceived TPACK knowledge depending on teachers' age or amount of teaching experience?
3 How do Finnish EFL teachers think the period of emergency remote teaching due to the COVID-19 pandemic in spring 2020 affected their ICT skills and thereby their perceived TPACK?

Based on previous research, discussed in Sections 2 and 3, it is hypothesized that Finnish EFL teachers' knowledge of different TPACK domains is relatively high (above the scale average), while the level of TPACK is somewhat lower. This is anticipated because of both the results obtained on TPACK internationally as well as the research results on Finnish teachers' technological skills. Further, it is hypothesized that there are some differences in TPACK

between teachers of different age and teaching experience: namely, younger and more novice teachers are expected to have a higher level of knowledge in the technology-related domains than their older and more experienced colleagues. Finally, the period of ERT in spring 2020 is hypothesized to have improved Finnish EFL teachers' ICT skills at least to some extent.

## 4.1 Participants

A total of 70 subjects participated in the study, all of whom were teachers of English in educational institutions in Finland. One subject did not give permission to use their answers in the study, leading to their answers being excluded and making the number of participants included in the study 69. Possible research subjects were approached via six different Facebook groups consisting of either Finnish teachers of English or teachers of languages in general. One group was aimed at classroom teachers, some of whom also teach English. In order to reach an adequate number of participants, the study was not limited to teachers on any specific educational level. Although there were some thousands of members in each group, it is impossible to estimate how many of them the study reached and therefore how representative the sample is. As is the case for most master's theses, a generalizable sample that would represent all EFL teachers in Finland was not possible to achieve due to the limited scope of this study (Alanen 2011, 154).

***Table 1*** *Participants' age distribution*

| *Age* | *Frequency* | *Percentage* |
|---|---|---|
| *Under 30* | 10 | 14.5 |
| *30-39* | 21 | 30.4 |
| *40-49* | 19 | 27.5 |
| *50-59* | 16 | 23.2 |
| *60 or older* | 3 | 4.4 |
| *Total* | 69 | 100.0 |

***Table 2*** *Participants' teaching experience*

| *Experience* | *Frequency* | *Percentage* |
|---|---|---|
| *Less than 5 years* | 12 | 17.4 |
| *5-10 years* | 13 | 18.8 |
| *11-20 years* | 20 | 29.0 |
| *21-30 years* | 17 | 24.6 |
| *Over 30 years* | 7 | 10.1 |
| *Total* | 69 | 100.0 |

## 4.2 Questionnaire and Data Collection

The data were gathered at the turn of August and September 2020 as a one-time online survey. Using the platform Webropol, a questionnaire was created to collect the data. Questionnaires are a popular instrument in second language research because they are easy to construct and provide an effective way to collect a large quantity of material with relatively little effort (Alanen 2011, 160; Rose, McKinley & Briggs Baffoe-Djan 2020, 154). Especially when conducted online, questionnaires are also a less intrusive way to gather data, as they allow the participants to decide when completing the survey best fits their schedule (Iwaniec 2019, 325). In addition, questionnaires can often be completed anonymously, which both encourages honest answers as well as increases the ethicality of the research (Dörnyei 2010, 17; Rose, McKinley & Briggs Baffoe-Djan 2020, 154). Although questionnaires have been criticized for being superficial and steering the respondents' answers into a prescribed direction (Alanen 2011, 160; Iwaniec 2019, 327), their role in TPACK research has become quite established (Scott 2021, 118), which is why a questionnaire was also used in this study.

As suggested by Alanen (2011, 152), the questionnaire was divided into sections, which were further organized in a manner that would best maintain the respondents' interest. There were three main sections in total: background information and access to technological devices, the TPACK items, and finally questions about the ERT in spring 2020 due to the COVID-19 pandemic. The organization of the sections included, for example, placing the simplest questions regarding background information first, and open-ended questions regarding emergency remote teaching last (Dörnyei 2010, 48; Alanen 2011, 152). An introduction containing key information about the study, as well as a privacy statement, were provided before the main body of the questionnaire to motivate the participants and allow them to make an informed decision about their participation, thus ensuring the data were gathered as ethically as possible (Iwaniec 2019, 333).

The questionnaire was piloted with five people before actually conducting the study. As an important part of questionnaire construction, piloting provides the researcher with valuable feedback on, for example, the clarity of the questions and the amount of time it takes to complete the survey (Rose, McKinley & Briggs Baffoe-Djan 2020, 162). Two of the people participating in the piloting were studying to become foreign language teachers and

therefore close to the target group of respondents, which is recommended when piloting a questionnaire (Alanen 2011, 154). The piloting participants also tested the user-friendliness of the questionnaire by filling it using different devices, including a laptop, a tablet, and a mobile phone, which were presumed to be the devices also used by the actual participants (Iwaniec 2019, 332). Minor changes were made to the wording of some statements following the feedback from the piloting.

The first main section of the questionnaire, which mapped the subjects' background information, included multiple-choice questions about their educational background, age, teaching experience, the level of education at which they taught, and the possible subjects they taught in addition to English. Because Finnish teachers' technological skills seem to correlate more strongly with their age than with their gender (as was discussed in the theoretical section), participants were not required to report their gender in their background information. Second, there was a multiple-choice question about which technological devices the subjects had access to while teaching, ranging from a computer to a smartphone and even leaving a space for open answers. Finally, the subjects were to estimate how extensively and how often their students had access to a technological device (a laptop or a tablet) during English lessons. Due to the limited scope of the study, only the demographic information regarding age and teaching experience were analyzed, and the remaining background details were dismissed.

The actual TPACK questionnaire used in this study was created by Baser, Kopcha & Ozden (2016). Originally developed for measuring pre-service EFL teachers' TPACK, the questionnaire was chosen because it was created specifically for EFL teachers. A ready-made questionnaire was used because of its proven validity (Baser, Kopcha & Ozden 2016, 749), although the level of validity may be different in the Finnish context. Using an already existing questionnaire is also supported by the fact that research topics that have already become established in a field can (and even should) often be studied using the precise and carefully constructed survey items stemming from previous research (Alanen 2011, 148). A 5-point Likert scale was used to measure each item. As suggested by Dörnyei (2010, 49), the questionnaire was translated into the respondents presumed first language, Finnish, to increase the quality of the obtained data.

While the original survey by Baser, Kopcha & Ozden consisted of 39 items, it was shortened to 30 statements due to the more limited scope of this study. The sections related to content knowledge (items 10–14 in the original survey) and technological content knowledge (items 26–28) were completely omitted. In addition, item 38 (regarding the use of Web 2.0 tools) was left out. These items were deemed omissible because both content knowledge and pedagogical knowledge of Finnish teachers is known to be high; all teachers are required to have a master's degree with at least 60 ECTS in English and at least 60 ECTS in educational science (5 § in the Decree on Qualification Requirements for Teaching Staff).

Finally, there were questions about how the subjects thought the period of emergency remote teaching in spring 2020 due to the COVID-19 situation had affected their ICT skills. Depending on whether the subjects thought their skills had changed or not, they could choose how the skills had changed (improved or declined) and finally describe their experiences with emergency remote teaching in their own words. Open-ended questions where the participants can use their own words are often used when investigating new phenomena (Alanen 2011, 148). In addition, providing the participants with this freedom of expression conveys the message that their input is truly valued (Iwaniec 2019, 331).

## 4.3 Data Analysis

The data matrix was exported directly from Webropol to the statistical analysis software SPSS for analysis. The important step of coding the data was done automatically by Webropol, and only the coding frames, such as labels and values of the variables, had to be defined manually (Dörnyei 2007, 199–201). Data screening resulted in almost no data cleaning or manipulation because the dataset did not include much missing or impossible data (Dörnyei 2007, 202–204), mainly because the online questionnaire prevented such cases. However, the multiple-choice questions regarding ERT were completely omitted, as they had not been set as mandatory in Webropol and were therefore not responded to by any of the participants. Participants' ERT experiences were instead studied based on their answers to the yes/no questions and the open-ended questions.

To make the data more manageable (Dörnyei 2007, 206), the number of variables was reduced from the initial 30 to 6 (one for each TPACK component analyzed in this study, as

well as a total score for the entire questionnaire). A factor analysis of the items had already been conducted in the original research (Baser, Kopcha & Ozden, 755), based on which the items were deemed groupable. The internal consistency of the grouped items was ensured by the Cronbach Alpha coefficient (Dörnyei 2007, 206–207; Rose, McKinley & Briggs Baffoe-Djan 2020, 164), which resulted in scores ranging mainly from .80 to .85 and .70 for one component, TPK. A score over .80 indicates high internal consistency between the grouped items, and the .70 — also acceptable — is possibly due to the small number of items (4) concerning the TPK component (ibid.). Data reduction was conducted by computed the mean of the interrelated items (Dörnyei 2007, 206; Rose, McKinley & Briggs Baffoe-Djan 2020, 164), which meant items 1-9 for TK, 10–15 for PK, 16–20 for PCK, 21–24 for TPK, 25–30 for TPACK, and 1-30 for TPACK Total.

***Table 3*** *Spearman correlation matrix of the TPACK components*

| *Variable* | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|
| *1 TK* | – | – | – | – | – |
| *2 PK* | .316** | – | – | – | – |
| *3 PCK* | .230 | .818** | – | – | – |
| *4 TPK* | .344** | .622** | .611** | – | – |
| *5 TPACK* | .659** | .546** | .479** | .570** | – |
| *6 TPACK Total* | .748** | .782** | .723** | .726** | .851** |

*n=69, ** p<0.01.*

The correlation between the TPACK components was measured with the Spearman correlation test, the results of which are represented as a correlation coefficient matrix in Table 3. A significant positive correlation was found between TK, TPK, TPACK, and TPACK Total; PK, PCK, TPK, TPACK, and TPACK Total; TCK, TPK, TPACK, and TPACK Total; TPK, TPACK, and TPACK Total, and TPACK and TPACK Total. This suggests that the TPACK components were correlated, and that the questionnaire was appropriate to evaluate teachers' TPACK (Redmond & Peled 2019, 2045).

Already when inspected visually, there appeared to be very small variance across the responses to the TPACK items, indicating that the data might not be normally distributed.

Therefore, tests of normality were run to clarify the situation. Determining whether the data are normally distributed or not is an important step in deciding which statistical tests are applicable: parametric tests can and should be used if the data are normally distributed, whereas non-parametric tests should not be used for data that is not normally distributed (Dörnyei 2007, 208). As is illustrated in Table 4, the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) tests of normality gave slightly different results; according to the K-S results, all variables except PCK Overall and TPACK Overall were normally distributed ($p>0.05$). However, the S-W results indicated that only TPACK Total was normally distributed ($p>0.05$). Due to this discrepancy, as well as the relatively small sample size, non-parametric tests were chosen so that unfounded statistical significance would not be observed during the analysis.

***Table 4*** *Results of the tests of normality*

| | *Kolmogorov-Smirnov*[a] | | | *Shapiro-Wilk* | | |
|---|---|---|---|---|---|---|
| | *Statistic* | *df* | *Sig.* | *Statistic* | *df* | *Sig.* |
| *TK Overall* | .099 | 69 | .090 | .962 | 69 | .034 |
| *PK Overall* | .086 | 69 | .200* | .959 | 69 | .023 |
| *PCK Overall* | .109 | 69 | .042 | .950 | 69 | .008 |
| *TPK Overall* | .092 | 69 | .200* | .959 | 69 | .024 |
| *TPACK Overall* | .135 | 69 | .003 | .961 | 69 | .031 |
| *TPACK Total* | .061 | 69 | .200* | .970 | 69 | .092 |

**. This is a lower bound of true significance.*

*a. Lilliefors Significance Correction*

Descriptive statistical analysis, such as measures of central tendency and measures of variability, was first conducted on the data to achieve an overview of the respondents and their answers. The overall level of TPACK and its components was investigated first, after which the respondents were divided into groups according to age and teaching experience for inferential statistical analysis. Inferential statistical tests are used to determine whether any generalizable conclusions could be drawn from the results (Dörnyei 2007, 209). The relationship between TPACK results and age and between TPACK and teaching experience were compared with the non-parametric Kruskal-Wallis test (Dörnyei 2007, 230).

Finally, the answers to the open-ended question regarding ERT were studied using content analysis, a basic method in qualitative research (Tuomi & Sarajärvi 2009, 91–93). Based on this analysis, the answers were grouped thematically and categorized into two groups: those regarding the development of ICT skills and those including other observations. The frequencies of different themes observed in the remarks about ICT skills were also analyzed quantitatively to determine how often each theme was brought forward by the respondents.

# 5 Finnish EFL Teachers' Perceived TPACK

This section presents and analyzes the main findings of the present study. Each research question is considered in its own section, and the findings are contrasted with previous research. First, Finnish EFL teachers' level of TPACK is discussed, starting from an analysis on the overall results and then focusing on different TPACK domains separately. Second, an analysis on the relationship between demographic factors of age and teaching experience and TPACK is presented. Finally, Finnish EFL teachers' experiences of the ERT caused by the COVID-19 pandemic are explored.

## 5.1 Level of Knowledge

A summary of the descriptive statistics and internal reliability analysis for the overall level of the TPACK components is provided in Table 5. The item-specific statistics are presented later in Sections 5.1.1 and 5.1.2. Although median and interquartile range are usually considered to better describe non-parametric data, mean and standard deviation are given as the key figures to make the data comparable to earlier studies.

In general, the participating EFL teachers' perceived knowledge in each TPACK domain was consistently high, with a mean score of approximately 4.00 for each knowledge component, and the standard deviation (SD) varying from only 0.43 to 0.60 across the different domains. Compared to research conducted in other countries, Finnish EFL teachers' knowledge of teaching with technology appears to be slightly higher than in Turkey, Saudi Arabia, and Indonesia, where mean scores of approximately 3.50 have been measured by Kozikoğlu & Babacan (2019), Alharbi (2020), and Mukminin, Habibi & Fridiyanto (2020). Finnish EFL teachers' knowledge seems to be on a level similar to that of their Taiwanese colleagues, who received mean scores varying approximately from 5.00 to 6.00 out of 7 in each domain when studied by Wu & Wang (2015) and Hsu (2016). Finland and Taiwan have both been successful in the international PISA studies, conducted by OECD, and the high quality of the educational system could be a factor in explaining the similar, high results.

I will now proceed to present the domain-specific results in more detail. Due to the small variance in the results across the different knowledge domains, the discussion is divided into two sections — according to technology-unrelated and technology-related domains — rather than five for each knowledge domain. This means that the analysis on pedagogical knowledge and pedagogical content knowledge (PK and PCK) forms Section 5.1.1, and technological knowledge, tehcnological pedagogical content, and technological pedagogical content knowledge (TK, TPK, and TPACK) are analyzed together in Section 5.1.2.

***Table 5*** *Descriptive statistics and internal reliability analysis of TPACK and its components*

| *Variable* | *Mean* | *SD* | *Skewness* | *α* |
|---|---|---|---|---|
| *TK Overall* | 4.15 | .54 | -.453* | .85 |
| *PK Overall* | 4.15 | .49 | -.591* | .80 |
| *PCK Overall* | 4.26 | .50 | -.436* | .80 |
| *TPK Overall* | 4.05 | .60 | -.292* | .70 |
| *TPACK Overall* | 3.95 | .60 | -.582* | .82 |
| *TPACK Total* | 4.11 | .43 | -.589* | .93 |

*n=69, * Std. error=.289*

### 5.1.1 PK and PCK

Table 5 illustrates the summarized descriptions and the descriptive statistics for each item regarding PK and PCK. The mean score for almost every item was slightly over 4.00, while the standard deviation varied from 0.56 to 0.86. The only exception was item PK6, which had a mean of 3.74. The results indicate that the participating Finnish EFL teachers' confidence in their knowledge unrelated to technology is high, and that there is very small variation among the respondents. The high level of pedagogical and content knowledge could be due to the high level of education that is required of teachers in Finland. All qualified teachers have a master's degree, unlike in many other countries, where a bachelor's degree is the minimum requirement.

The high level of PK and PCK is similar to the results that have been obtained in other countries, being only slightly higher than in Turkey and Saudi Arabia (Kozikoğlu & Babacan 2019; Alharbi 2020). However, the high levels of PK and PCK do not vary much from the mean scores for the technology-related knowledge domains of TK, TPK, and TPACK, unlike in some

countries, where the high levels of PK and PCK differ significantly from the participants' knowledge of the technology-related domains. This was the case in, for example, Indonesia (Mukminin, Habibi & Fridiyanto 2020), Iran (Nazari et al. 2019), and Taiwan (Wu & Wang 2015). In fact, Iranian EFL teachers scored almost full marks on PK and PCK, indicating an even higher level of knowledge than that of their Finnish colleagues participating in this study.

***Table 6*** *Item-specific descriptive statistics of PK and PCK*

| # | *Description* | *M* | *SD* |
|---|---|---|---|
| | **Pedagogical knowledge (PK)** | | |
| *1* | Using appropriate teaching methods and techniques | 4.23 | .60 |
| *2* | Designing teaching that fits the students' level | 4.35 | .64 |
| *3* | Supporting students' learning with respect to their differences | 4.10 | .77 |
| *4* | Collaborating with school stakeholders | 4.32 | .72 |
| *5* | Applying experiences from professional development programs to teaching | 4.16 | .63 |
| *6* | Supporting students' out-of-class work to facilitate their learning | 3.74 | .78 |
| | **PK Overall** | **4.15** | **.49** |
| | **Pedagogical content knowledge (PCK)** | | |
| *1* | Managing a classroom learning environment | 4.20 | .66 |
| *2* | Evaluating students' learning processes | 4.06 | .86 |
| *3* | Using teaching methods that support students in developing language skills | 4.36 | .62 |
| *4* | Preparing curricular activities that support the lesson goal | 4.33 | .56 |
| *5* | Adapting lesson plans to students' language skill levels | 4.32 | .63 |
| | **PCK Overall** | **4.26** | **.50** |

*n=69.*

### 5.1.2 TK, TPK, and TPACK

Similarly to the technology-unrelated components of PK and PCK, the participants' perceived knowledge in the technology-related domains TK, TPK, and TPACK was high, with the overall mean scores varying from 3.95 for TPACK to 4.15 for TK (SD varying from 0.43 to 0.60). The technology-related knowledge of Finnish EFL teachers appears to be high when contrasted internationally, with only Taiwan being on the same level (Wu & Wang 2015) or slightly ahead (Hsu 2016). However, with mean scores of approximately 3.50, the knowledge of Turkish and Saudi Arabian EFL teachers is not far from that of the participating Finnish EFL teachers (Kozikoğlu & Babacan 2019; Alharbi 2020). A significant difference in the level of technology-related knowledge can be detected when compared to the studies conducted in

Indonesia (Mukminin, Habibi & Fridiyanto 2020) and Iran (Nazari et al. 2019), where the participating teachers' mean scores were considerably below the average level of the scale.

***Table 7*** *Item-specific descriptive statistics of TK, TPK, and TPACK*

| # | *Description* | *M* | *SD* |
|---|---|---|---|
| | **Technological Knowledge (TK)** | | |
| *1* | Using basic technological terms appropriately | 4.67 | .51 |
| *2* | Adjusting computer settings | 4.57 | .74 |
| *3* | Using computer peripherals (printer, scanner etc.) | 4.81 | .39 |
| *4* | Troubleshooting common computer problems independently | 4.03 | .91 |
| *5* | Using digital classroom equipment (projectors, smart boards etc.) | 4.80 | .41 |
| *6* | Proficiency with Office programs | 4.38 | .73 |
| *7* | Creating multimedia (videos, websites etc.) | 3.35 | 1.14 |
| *8* | I can use collaboration tools (wiki, Edmodo etc.) | 2.49 | 1.24 |
| *9* | Learning new software | 4.23 | .79 |
| | **TK Overall** | **4.15** | **.54** |
| | **Technological Pedagogical Knowledge (TPK)** | | |
| *1* | Meeting students' individualized needs by using ICT | 4.12 | .72 |
| *2* | Leading students to use ICT legally, ethically, and safely | 4.14 | .79 |
| *3* | Supporting students' ICT use to develop their higher order thinking abilities | 3.75 | .85 |
| *4* | Managing the classroom learning environment while using ICT | 4.20 | .90 |
| | **TPK Overall** | **4.05** | **.60** |
| | **Technological pedagogical content knowledge (TPACK)** | | |
| *1* | Deciding when technology benefits teaching a specific topic | 4.48 | .58 |
| *2* | Designing learning materials by using ICT that supports language learning | 4.04 | .93 |
| *3* | Using multimedia to support students' language learning | 4.32 | .83 |
| *4* | Using collaboration tools (wiki etc.) to support students' language learning | 2.61 | 1.10 |
| *5* | Supporting students' independent ICT use in language learning | 4.07 | .71 |
| *6* | Using ICT to improve teaching and to develop professionally | 4.16 | .72 |
| | **TPACK Overall** | **3.95** | **.60** |
| | **TPACK Total** | **4.11** | **.43** |

*n=69.*

Especially high scores of 4.81 and 4.80 can be detected for items TK3 and TK5, measuring the teachers' perceived ability to use computer peripherals and digital classroom equipment. The frequencies of responses to these items are illustrated in Figure 2. Approximately 80 percent of the participants completely agreed to both statements, and even the remaining 20 percent responded they somewhat agreed to the statements. This, as well as the high scores in TK overall, indicate that none of the participants felt their knowledge of

using basic technology in teaching was somehow insufficient. This is less than what teachers reported in the more comprehensive study of Finnish teachers' technological skills (Tanhua-Piiroinen et al. 2020), where 10 percent of teachers considered their ICT skills as insufficient and wished for more training in the basic use of different devices. The difference is most likely explained with the relatively small sample size and the participants' assumed interest in technology, as they had all joined technology-related Facebook group on their own initiative.

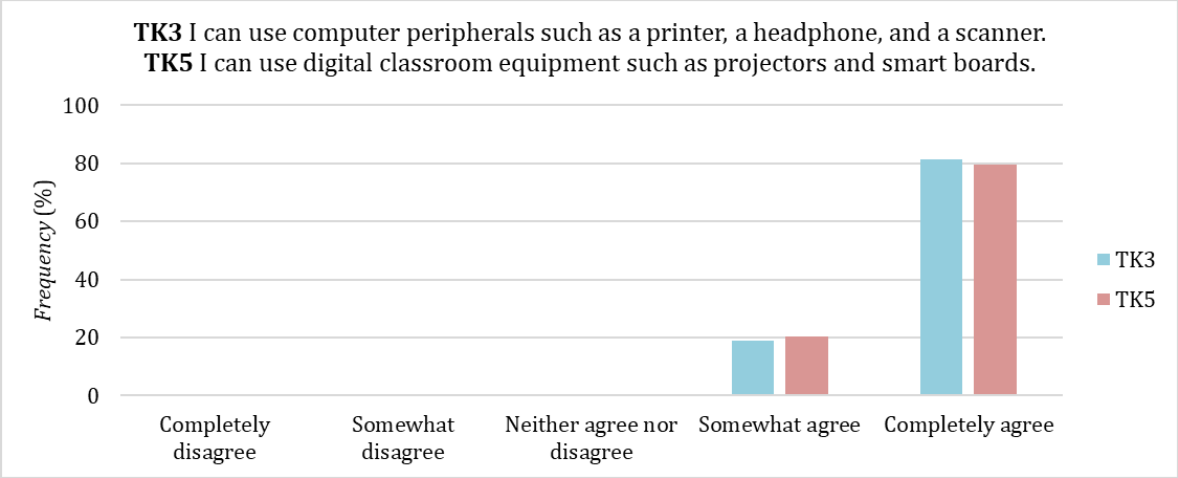



***Figure 2*** *Frequencies of responses to items TK3 and TK5 (n=69)*

One of the TK items with the lowest mean scores was TK7, which measured the participants' perceived ability to create multimedia, such as videos and web pages. Although approximately a half of the respondents (53.6%) agreed with the statement somewhat or completely, a third of them (28.9%) disagreed, indicating a perceived insufficiency in their skills. These findings are illustrated in Figure 3. This result aligns with the findings of Tanhua-Piiroinen et al. (2020, 83–84) and Korkeakoski (2019, 40), who concluded that Finnish teachers wished for more training especially in creating digital content.

The participating teachers appeared to be significantly less familiar with collaboration tools, such as wiki and edmodo, than they were with other aspects of technology. This is indicated by the lower mean scores of 2.49 and 2.61 for the items TK8 and TPACK4, related to the ability to use such tools (SD=1.24 and 1.10). The frequencies of responses to these items are represented in Figures 4 and 5, indicating that a mere fourth of the respondents (23.2%) agreed with the statement TK8 somewhat or completely, while

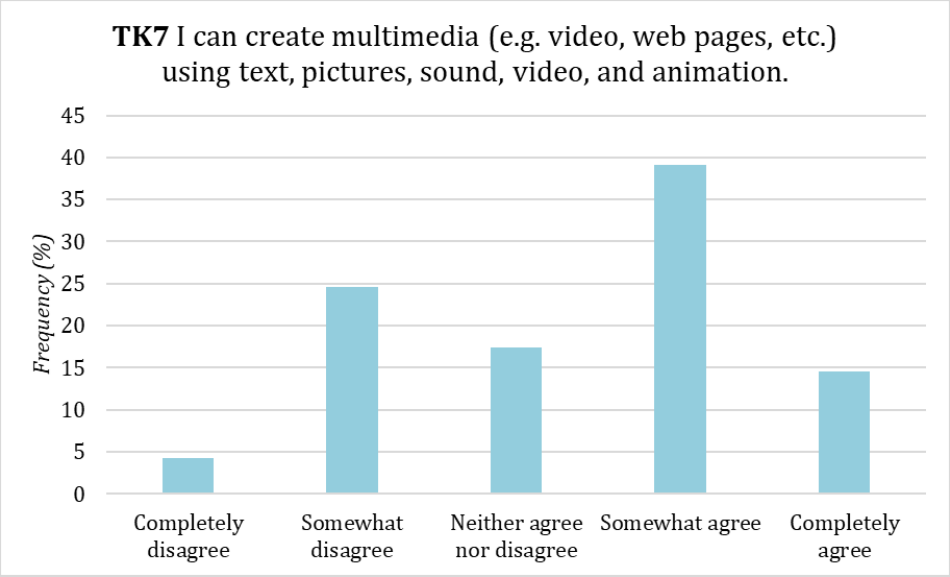



***Figure 3*** *Frequencies of responses to item TK7 (n=69)*

the remaining majority either disagreed or were of neither opinion. For TPACK4, the frequency of those agreeing to the statement was even lower (18.8%), with over a third of the participants stating they neither agree nor disagree.

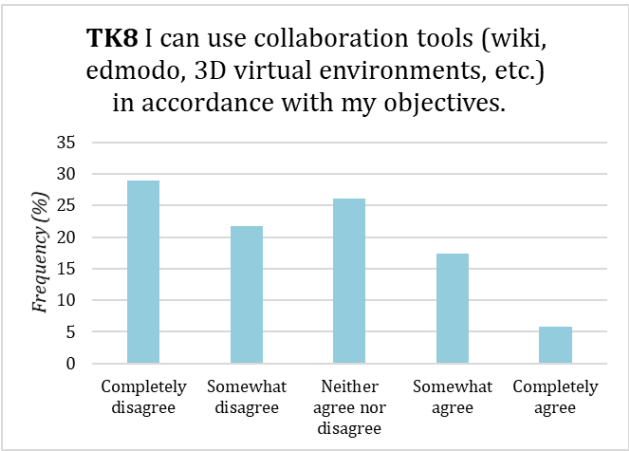



***Figure 4*** *Frequencies of responses to item TK8 (n=69)*

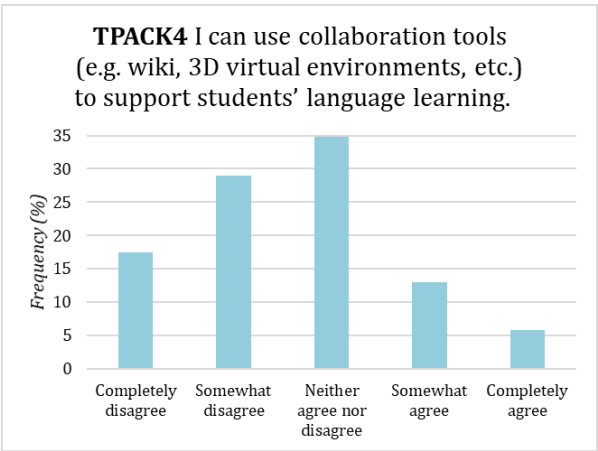



***Figure 5*** *Frequencies of responses to item TPACK4 (n=69)*

The low scores for these items could possible be due to the context-sensitivity of TPACK; the self-assessment instrument used in this study was developed and validated in the Turkish context, and almost no changes were made to it before conducting this study.

Therefore, it is likely that because collaboration tools were included in the original questionnaire, they are common practice in Turkish EFL classrooms, unlike in Finland, as they appear rather unfamiliar to Finnish EFL teachers based on this study. This could also explain the high frequencies of participants responding *neither agree nor disagree* to these statements; they were perhaps undecided because of their unfamiliarity with collaboration tools, rather than having tried such tools and being certain they cannot use them.

Finally, the mean scores in the domain of TPACK (M=3.96, SD=0.60) as well as the total TPACK considering all 30 items (M=4.11, SD=0.43) were close to 4.00, consistently with the scores in other domains. The mean score was especially high for item TPACK1, which measured the respondents' condifence in their ability to decide when using technology would benefit their teaching of specific English content (M=4.48, SD=0.58). As illustrated in Figure 6, the vast majority of the participants (95.7%) agreed with the statement either somewhat or completely, and only 4.3 percent responded *neither agree nor disagree*. None of the participants disagreed with the statement.

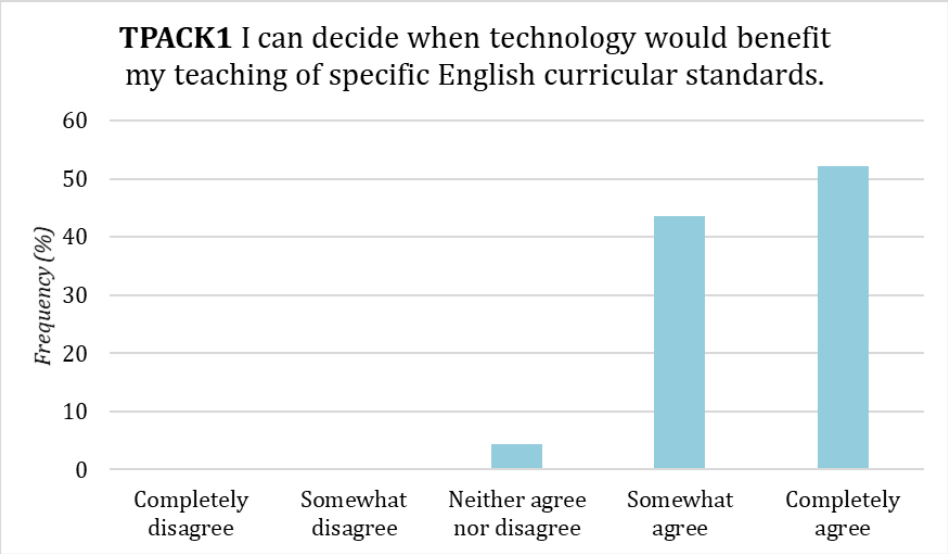



***Figure 6*** *Frequencies of responses to item TPACK1 (n=69)*

Although the scores for TPACK were somewhat higher, the fact that Finnish EFL teachers' level of TPACK was approximately as high as the knowledge of PK and PCK aligns with the results obtained in Turkey and Saudi Arabia (Kozikoğlu & Babacan 2019; Alharbi

2020). Of the previous studies on EFL teachers' TPACK, considered in the theoretical section, mean scores higher than that of Finnish EFL teachers were only measured in the Taiwanese context by (Hsu 2016), and Finnish teachers scores for TPACK appear to be significantly higher than those of Indonesian and Iranian EFL teachers (Nazari et al. 2019; Mukminin, Habibi & Fridiyanto 2020). The significantly higher levels of TPACK in both Finland and Taiwan could be due to the technologically advanced nature of both societies, whereas other countries may not have equally extensive access to technology or have only gained such access in recent years. Especially in Indonesia, where the majority of the participants explained they had had somewhat limited exposure to technology and constantly faced a lack of technological resources, this could be an explanatory factor (Mukminin, Habibi & Fridiyanto 2020, 32–33).

## 5.2 TPACK across Demographic Groups

The level of TPACK will now be analyzed with relation to the participants' background factors. The analysis is divided into two sections: Section 5.2.1 considers the relationship between TPACK and age, and Section 5.2.2 compares the TPACK levels of teachers with different amounts of teaching experience.

### 5.2.1 Age

Minor differences could be detected in the participants' perceived level of knowledge in some TPACK domains when analyzed with regard to age. As illustrated in Figure 7, the scores for TK and TPACK Overall (labeled TPACK O in the figure) seem to be slightly higher for those under 30 (M=4.37 for TK; M=4.25 for TPACK O) and decrease in the older age groups (M=4.15/4.15/4.02 for TK; M=3.93/3.96/3.79 for TPACK O). However, due to the variance being so small across different age groups, the differences were not found statistically significant in any TPACK domain (p-values varying from 0.416 to 0.956 across domains). Although not much emphasis can be placed on such minor differences, it is worth mentioning that such trends in TK and TPACK would align with the results obtained by Tanhua-Piiroinen et al. (2020, 70) and Korkeakoski (2019, 66–67) who concluded that Finnish teachers'

technological skills appear to correlate with age, with younger teachers usually having better ICT skills than their older colleagues.

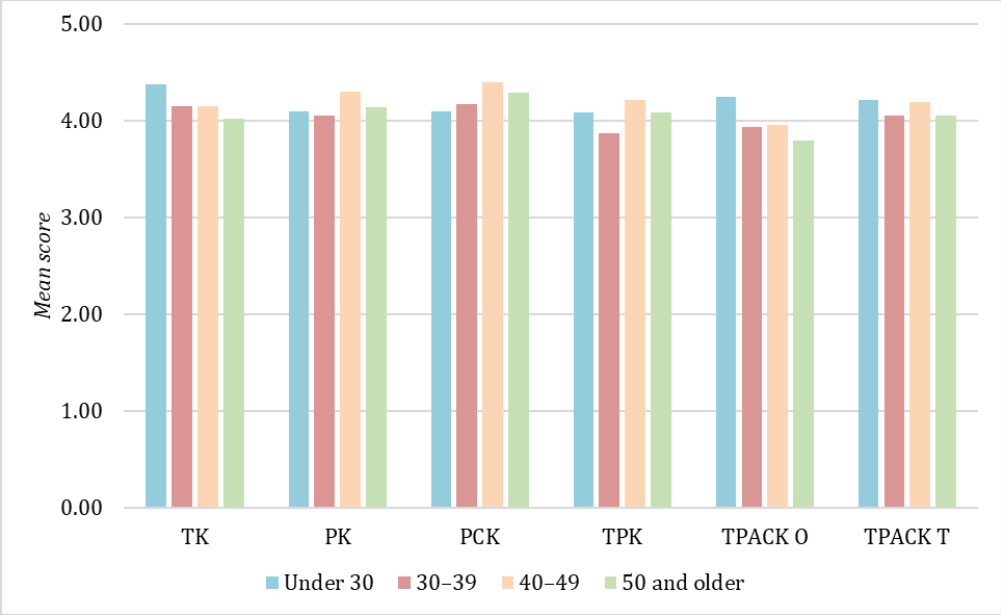



***Figure 7*** *TPACK scores across different age groups (n=69)*

### 5.2.2 Teaching Experience

As with age, minor differences could be also detected in the scores for some TPACK domains based on the participants' reported teaching experience, although again not significant statistically (p-values varying from 0.079 to 0.557 across domains). As can be seen from Figure 8, the scores for PCK appear to be slightly higher for those with five or more years of teaching experience, whereas the scores for TK, TPACK Overall, and TPACK Total are slightly higher for the groups with under 10 years of experience. These findings, although very marginal, align with the results obtained in Iran by Nazari et al. (2019), who concluded that novice Iranian EFL teachers had significantly higher scores in TK and TPACK, whereas experienced teachers had a better command of PCK.

The paucity of differences between novice and experienced EFL teachers in Finland could possibly be due to two major factors: first, less experienced teachers appearing to have almost as high levels of PK and PCK as those with over 10 years of experience could be explained by the high level of teacher education in Finland. Although a teacher's pedagogical

competence generally develops with experience, even those with less experience feel they have a good command of pedagogy following their teacher education. Second, the fact that the more experienced teachers' scores in the technology-related knowledge domains of TK, TPK, and TPACK are not much lower than those with less experience could stem from the technologically advanced nature of the Finnish society: even the experienced teachers have been around technology in their private lives as well as in teaching for years, although to a lesser extent than they are today.

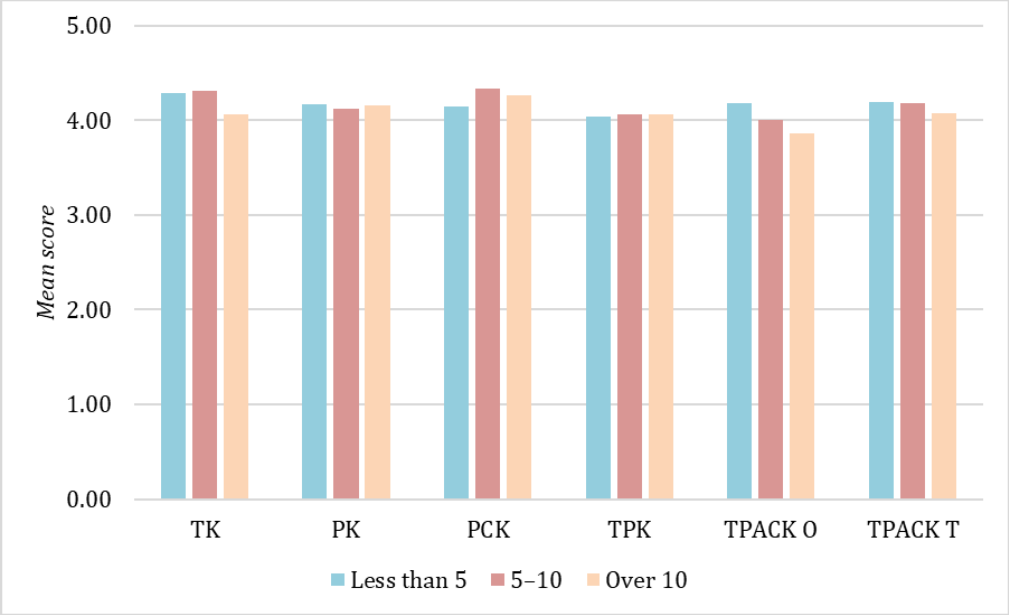



***Figure 8*** *TPACK scores based on years of teaching experience (n=69)*

## 5.3 The Effects of ERT on Teachers' Skills

As illustrated in Table 8, the majority of the participants (79.7%) reported that the period of ERT during the COVID-19 pandemic had improved their skills in teaching with technology. Quite naturally, ERT had not resulted in a decline in any respondents' technological skills. However, a fifth of the respondents (20.3%) were of the opinion that their ICT skills had remained the same through the exceptional circumstances. This can be explained by the fact that the technology-related knowledge of the respondents who reported their skills did not change was (and is) very high, thus indicating that they were familiar with using technology in teaching even before the COVID-19 pandemic struck.

***Table 8*** *Participants' report of how ERT affected their ICT skills, and their mean scores for the technology-related knowledge domains TK, TPK, TPACK, and TPACK Total*

| *Response* | *f* | *%* | *M (TK)* | *M (TPK)* | *M (TPACK)* | *M (TPACK Total)* |
|---|---|---|---|---|---|---|
| *My skills improved* | 55 | 79.7 | 4.05 | 3.98 | 3.90 | 4.05 |
| *My skills declined* | 0 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 |
| *ERT did not affect my skills* | 14 | 20.3 | 4.51 | 4.36 | 4.12 | 4.34 |
| *Total* | 69 | 100.0 | 4.15 | 4.05 | 3.95 | 4.11 |

Further illustrated in Table 8, the mean scores for the technology-related knowledge domains TK, TPK, and TPACK Total were higher for the respondents who reported no change in their skills than for those who felt their skills had improved. Especially the scores for TK and TPK were close to the maximum score of 5.00, being 4.67 and 4.50 respectively, whereas the mean scores for those who felt their skills had improved were somewhat lower, 4.11 and 4.00 for TK and TPK respectively. The relationships between TK, TPK and TPACK Total were also found statistically significant, as illustrated in Table 9 ($p<0.05$).

***Table 9*** *Results of the Mann-Whitney U test*

| | *TK Overall* | *PK Overall* | *PCK Overall* | *TPK Overall* | *TPACK Overall* | *TPACK Total* |
|---|---|---|---|---|---|---|
| *Mann-Whitney U* | 181.500 | 322.000 | 319.500 | 237.000 | 321.000 | 236.500 |
| *Wilcoxon W* | 1721.500 | 1862.000 | 1859.500 | 1777.000 | 1861.000 | 1776.500 |
| *Z* | -3.044 | -.946 | -.986 | -2.228 | -.961 | -2.217 |
| *Asymp. Sig.(2-tailed)* | **.002** | .344 | .324 | **.026** | .337 | **.027** |

*Grouping Variable: Did the period of emergency remote teaching in spring 2020 affect your ICT skills?*

Finally, a total of 13 subjects (19% of the participants in total) responded to the optional open-ended question where the teachers had a chance to further share their experiences of the period of ERT in spring 2020. In general, the responses seemed very positive, and the respondents described several ways in which ERT had improved their use of technology and even teaching in general. The responses included a total of 14 observations regarding the ways in which the participants felt their ICT skills had improved, and 13 observations regarding other aspects than improving their technological skills. The

frequencies of different ways in which the participants reported their ICT skills had improved are illustrated in Table 10.

***Table 10*** *The ways in which participants reported their ICT skills had improved (n=13)*

| *Skill* | *Frequency* | *Percentage* |
|---|---|---|
| *New software and technological methods* | 5 | 35.7 |
| *New practices* | 4 | 28.6 |
| *Confidence in using technology* | 2 | 14.3 |
| *Realizing what could be improved technology-wise* | 2 | 14.3 |
| *Evaluating technology* | 1 | 7.1 |
| *Total observations* | 14 | 100.0 |

As can be seen in Table 10, learning to use new software was the most common new skill that had been acquired during ERT, composing slightly more than a third of the observations (35.7%). These new applications and methods included learning to create instructional videos, learning to use new online video-communication software such as Google Meet and BigBlueButton, the screen recording software Screen-o-matic, and a tool for creating e-exams by the Finnish publisher Otava. Google Meet turned out to be the most used video-communication software for online lessons, mentioned by three respondents. Microsoft Teams was mentioned by one respondent.

Learning new practices for using technology was the second most common new skill, also composing roughly a third of the responses (28.6%). These new practices included more effective methods of teaching with technology, new ways in which technology can reduce the workload even during contact teaching, and other good practices, such as holding teacher meetings online rather than face to face, which made scheduling such meetings less complicated. Two respondents also mentioned that the period of ERT had given them confidence in using technology, and the same number of respondents explained that they had become more aware of how their ICT skills, realizing how they could further improve their teaching with technology. Finally, learning to evaluate the pros and cons of different technologies was mentioned in one response.

When it comes to the participants' observations not related to improved ICT skills, four of the thirteen respondents (30.8%) stated that they had been quite familiar with using technology even before ERT, and that they had mainly deepened their knowledge or learned to use new software, applications, or other technological methods during the exceptional situation. Other observations, one of each, indicated that ERT had required creativity and provided opportunities for trying entirely new things with technology while teaching. In addition, one participant mentioned they had trained their colleagues in using technology during ERT.

With respect to the negative aspects of ERT, only one respondent mentioned both the lack of technological devices as well as the insufficient amount of technological training which made remote teaching more difficult. One of the more experienced technology users also noted that planning lessons during ERT had taken more time compared to regular teaching, and that teaching in general had felt more exhausting. One participant also stated that the lessons taught using Google Meet felt quite useless for some students, although another noted that the varying level of participation across students had also increased their knowledge of each student's strengths and weaknesses.

The results obtained in this study regarding EFL teachers' experiences with ERT differ with previous research in that a somewhat smaller number of respondents (79.7%) reported that their ICT skills had improved than in the more comprehensive study on Finnish teachers where 94 percent felt their skill had improved at least somewhat (Ahtiainen et al. 2020, 17). However, in line with Ahtiainen et al.'s findings, the results obtained in this study also indicate that the period of ERT has had a permanent effect on the way teachers work: the unexpected circumstances provided an opportunity for establishing new practices that the participants think will be usable even in the future.

# 6 Discussion

The aim of this study was to explore the perceived level of TPACK among Finnish EFL teachers, the relationship between TPACK, age, and teaching experience, and the impact the teachers felt emergency remote teaching had had on their ICT skills. This section discusses the main findings of the study, being divided into three sections: first, the research questions are answered one by one by discussing the results of the study, contrasting them with previous research. Second, the limitations of the present study are considered, before finally making suggestions for future research.

## 6.1 Findings

The first research question was concerned with investigating Finnish EFL teachers' perceived level of Technological Pedagogical Content Knowledge (TPACK). This was investigated through a quantitative analysis of the participants' responses to the TPACK self-assessment instrument, originally developed by Baser, Kopcha & Ozden (2016) and translated into Finnish for this study. The findings indicated that Finnish teachers of EFL had a consistently high level of perceived knowledge in all TPACK domains, and that very little variance could be detected in the participants' responses to the items throughout the questionnaire. There were, however, a few items with lower mean scores and larger variation. These items were mainly concerned with using specific technological methods (collaboration tools), the unfamiliarity with which could possibly be explained by cultural preferences in technological tools and applications. All in all, the results indicated one clear target for development, which was teachers' knowledge of creating videos and other multimedia.

When contrasted with previous research, Finnish EFL teachers' TPACK appears to be generally higher than that of their colleagues in many countries. The high level of the Finnish scores is close to those obtained in Taiwan by Wu & Wang (2016) and Hsu (2016), although somewhat more variance could be detected in the Taiwanese setting; in Hsu's study, EFL teachers (n=158) had significantly higher scores for TPK and TPACK than for other knowledge domains. On the other hand, the TPACK of Finnish EFL teachers seems to be slightly higher than that of EFL teachers in, for example, Turkey and Saudi Arabia, where the

mean scores in all TPACK domains were approximately 3.5/5 (Kozikoğlu & Babacan 2019; Alharbi 2020). Furthermore, the level of knowledge in the technology-related domains appears considerably higher among Finnish than Indonesian and Iranian EFL teachers, who received mean TCK and TPACK scores of approximately 2.2/5 in Indonesia (Mukminin, Habibi & Fridiyanto 2020) and a TPACK mean of 7.5/36 in Iran (Nazari et al. 2019).

These results indicate that the participating Finnish EFL teachers are on a high level when it comes to the knowledge required for effective teaching with technology, described as TPACK. It would thus appear that they are well prepared to utilize technology in their teaching in the ways prescribed in the current NCC. Compared to previous results on Finnish teachers' technological skills, the participants were more homogenous in that they mostly received very high scores in the TPACK domains, whereas there appears to be more variation among Finnish teachers' level of technology-related knowledge in general (Tanhua-Piiroinen et al. 2020). This can partially be explained by the relatively small sample size in this study (n=69) but also by the assumption that most participants are at least somewhat interested in and active users of technology in teaching. All in all, the aspect worth emphasizing in the TPACK results is the relatively low mean score for the item measuring teachers' confidence in creating videos and other multimedia (M=3.35, SD=1.14). This indicates that to further improve Finnish EFL teachers' abilities in teaching with technology, more in-service training on creating multimedia is needed. These findings align with the results obtained in previous research in Finland (Tanhua-Piiroinen et al. 2020, 83–84)

The second research question sought to investigate what kinds of differences there were in the level of TPACK among Finnish EFL teachers of different ages and with different amounts of teaching experience. Previous research on Finnish teachers' technological skills has indicated that the skills seem to correlate with age and that younger teachers usually have better technological skills than their older colleagues (Korkeakoski 2019, 66–67; Tanhua-Piiroinen et al. 2020, 70). In addition, previous research on EFL teachers' TPACK has, in some contexts, indicated differences in novice and experienced teachers' levels of knowledge (Nazari et al. 2019), but such differences have not been detected in all studies (Kozikoğlu & Babacan 2019; Alharbi 2020). This study produced somewhat similar results, as minor differences could be detected in the mean scores for some TPACK domains when compared with age and experience: The levels of TK and TPACK Overall appeared to be

higher for those under 30 and decrease in the older age groups, whereas the scores for PCK were somewhat lower among the younger teachers. Similarly, when compared with regard to teaching experience, those who had taught for less than 5 years had higher scores in TK, TPACK Overall, and TPACK Total than those who had worked for 5–10 or over 10 years. However, no statistical significance was found in these differences with the p-values of the Kruskal Wallis test being less than 0.05.

As the differences were not found statistically significant, the results cannot be generalized to apply to the entire population. Then again, with relatively small sample sizes, such as in this study, widely generalizable implications can rarely be made. It is intriguing, however, that slight differences could be detected in the technology-related domains of TK and TPACK and the domain of PCK when compared with age and teaching experience. Such findings would align with previous research and indeed arouse interest in further research on the matter – something that is discussed in more detail in Section 6.3.

The third and final research question aimed at exploring how Finnish EFL teachers felt the period of emergency remote teaching (ERT) in spring 2020, caused by the COVID-19 pandemic, had affected their ICT skills and therefore their perceived TPACK. This was measured by the participants' responses to a simple yes/no question about whether they felt ERT had affected their skills, after which they could specify the impacts in their own words. Approximately 80 percent of the participants believed their ICT skills had improved during ERT, whereas the remaining 20 percent felt their skills had stayed the same. On a larger scale, ICT skills have been on the forefront of teachers experiences with ERT, while the vast majority of Finnish teachers mentioned their improved technological skills as the most positive aspect of remote teaching (Ahtiainen et al. 2020, 17; Taipale 2021, 41).

The results on experiences of ERT imply that the majority of the participating teachers felt their ICT skills had improved, thus indicating that their TPACK also had improved. In other words, had the level of Finnish EFL teachers' TPACK been explored prior to the period of ERT, the results would have been different. However, the extent of the improvement that occurred is impossible to determine within the parameters of this study. On the other hand, the number of participants reporting their ICT skills had not changed following ERT (20%) strikes as relatively high – in the preliminary results obtained by Ahtiainen et al. (2020, 17), the corresponding number was only 6 percent. This 20 percent had higher mean scores for

all technology-related domains, of which the difference was found statistically significant for TK, TPK, and TPACK Total. These findings indicate that these participants did not feel their ICT skills were improved during ERT simply because their skills were already so high before the transition to remote teaching. Differences in teachers' ICT skills could therefore have been more significant if investigated prior to ERT. Most importantly, the period of ERT appears to have affected Finnish EFL teachers' ICT skills in a permanent way: nearly 30 percent of the participants who responded to the open-ended question about the effects of ERT mentioned that the exceptional circumstances had led either them or their school to establish new practices which will facilitate teaching even in the future.

## 6.1 Limitations of the Present Study

As with all research, the results of this study should also be examined in light of some limitations. One of the two main limitations of this study is the way of the participants were sampled. In order for the findings of a study to be generalizable, it is important to ensure that the sample being investigated truly represents the entire population (Rose, McKinley & Briggs Baffoe-Djan 2020, 160). However, as Dörnyei (2007, 98; 2010, 60) points out, obtaining perfect representativeness is often unrealistic in applied linguistics research as scholars rarely have access to the entire population. Due to the limited scope and access of this study, the possible participants were approached via different Facebook groups, and all those willing to participate were selected; *convenience sampling* was thus applied instead of scientifically sound, *probability sampling* strategies (Dörnyei 2010, 97, 99). The findings can nonetheless be considered as an exploratory view of Finnish EFL teachers' TPACK and, as such, provide valuable information on the current state of English teachers' perceived knowledge of teaching with technology.

The second limitation of the study is the appropriateness of the TPACK instrument which was used. Because the questionnaire was developed and validated through a proper process, it was used as is in this study. However, after the data collection, it was observed that there was very little variance in the responses, indicating that the questionnaire was perhaps not constructed in a way that would be able to detect differences between respondents. Although it is also possible that Finnish EFL teachers' perceived TPACK simply

is consistently high in all domains, it is more likely that the questionnaire requires some adjustment to better suit the Finnish context and thus reveal even the more subtle differences among the respondents. All in all, even though the appropriateness of the questionnaire must be considered a limitation of the present study, it is definitely a valuable indication for future TPACK research in Finland, the direction of which will be discussed in the following section.

## 6.3 Suggestions for Future Research

With the increasing importance of technology in teaching, TPACK provides a comprehensive theoretical basis for studying the knowledge teachers need for successful technology integration. Based on the findings obtained in this study, I will now present some suggestions for future TPACK research in the Finnish context.

Although the findings of this study indicate that Finnish EFL teachers already have a high knowledge in technology integration, further research should be conducted on it in order to achieve more comprehensive and generalizable results. As this study has indicated, paying careful attention to the sampling process and, if possible, utilizing methods of probability sampling would increase the representativeness of the studied sample and thus provide more generalizable results. Because limited access is often reality in applied linguistics research, a more representative sample could also be obtained by approaching possible participants via other channels (such as e-mail) instead of (or in addition to) Facebook, where group members are usually at least somewhat interested in and familiar with using technology in their teaching. E-mail could reach even those who choose not to use Facebook and/or are not interested in participating in groups related to teaching with technology on their free time.

Furthermore, the findings indicate that a TPACK instrument adapted (or even specifically developed) for the Finnish context is preferable for achieving more precise results. The instrument used in this study had been used in other countries, as well, but might not be appropriate to measure Finnish teachers' TPACK due to the high context-sensitivity of TPACK in general. This aspect was revealed only after the data were collected and could not be acted upon because of the limited scope and resources of this study, thus providing an intriguing opportunity for future research. Most importantly, as this study only explored

Finnish EFL teachers' perceived TPACK, it would be interesting to examine teachers' abilities in practice – something that the TPACK framework provides opportunities for, as well. Investigating whether teachers' actual skills are on the same level as their self-reported knowledge would definitely provide valuable information on how the framework can be applied to improving teachers' knowledge in practice, which has desperately been called for in earlier TPACK research (Brantley-Dias & Ertmer 2013, 123; Angeli, Valanides & Christodoulou 2016, 24–25; Saubern et al. 2020, 1).

# 7 Conclusion

The purpose of this thesis was to explore the level of Finnish EFL teachers' perceived TPACK. Moreover, the thesis set out to investigate how the perceived level of TPACK varied between EFL teachers of different ages and with different amounts of teaching experience. Finally, the effects that EFL teachers felt emergency remote teaching due to COVID-19 had on their ICT skills and thus their perceived TPACK were also explored. The data were collected using the TPACK instrument for EFL teachers, developed and validated by Baser, Kopcha and Ozden (2016). The questionnaire, conducted as an online survey, provided quantitative data which were analyzed with SPSS. A total of 69 EFL teachers in Finland participated in the study.

The results indicated that the participating EFL teachers' level of TPACK was quite high as the mean scores for all knowledge domains were approximately 4/5. In addition, very small variance could be detected in the responses to different items and by different participants. The highest mean scores were received for pedagogical knowledge (M=4.15), pedagogical content knowledge (M=4.26), and for technological knowledge (M=4.15). The scores were approximately as high as those obtained by Taiwanese EFL teachers (Wu & Wang 2015; Hsu 2016), somewhat higher than those obtained in Turkey and Saudi Arabia (Kozikoğlu & Babacan 2019; Alharbi 2020), and significantly higher than those for EFL teachers in Indonesia (Mukminin, Habibi & Fridiyanto 2020). Finnish EFL teachers' knowledge in the technology-related domains was also significantly higher than that of their Iranian counterparts, although Iranian EFL teachers' scores in domains related to pedagogy and content were similar to those measured among Finnish teachers (Nazari et al. 2019). Only slight differences could be detected in the scores for some TPACK domains when examined in light of teacher age or teaching experience; although very modest, such differences would align with previous research on EFL teachers' TPACK (Kozikoğlu & Babacan 2019; Alharbi 2020) and with Finnish teachers' technological skills in general (Korkeakoski 2019, 66–67; Tanhua-Piiroinen et al. 2020, 70).

The results also indicated that the period of emergency remote teaching in spring 2020 had impacted most Finnish EFL teachers (80%) ICT skills in a positive way. The remaining 20 percent of the participants reported no change in their skills. Because they scored significantly higher in the TPACK questionnaire than those who felt their skills had

improved, it can be concluded that their knowledge of teaching with technology was high even prior to ERT. Had the TPACK of Finnish EFL teachers been investigated before COVID-19 struck in the spring of 2020, the results of this study would have been different at least to some extent.

The findings of the study imply that Finnish EFL teachers are confident in their ability to integrate technology into teaching and thus prepared to meet the ICT-related demands of the current NCC. Finnish EFL teacher education and different in-service training programs appear therefore to provide teachers with sufficient knowledge of how technology can be used to enhance EFL teaching and learning, although targets for development can also be identified. More training on creating videos and other multimedia is especially needed so that EFL teachers can utilize technology in their teaching even more effectively and extensively. Because the majority of the participants reported that their ICT skills had improved during to the period of ERT in spring 2020, using technology comprehensively in practice appears to have increased EFL teachers' confidence in their ability to use technology significantly. Therefore, teacher education as well as in-service training should, above all, encourage current and future teachers to put their ICT knowledge to practice, to boldly try out new ways, and to be curious about technology.

# References


Ahtiainen, Raisa, Mikko Asikainen, Lauri Heikonen, Ninja Hienonen, Risto Hotulainen, Pirjo Lindfors, Esko Lindgren, Meri Lintuvuori, Sanna Oinas, Arja Rimpelä, and Mari-Pauliina Vainikainen. *Koulunkäynti, opetus ja hyvinvointi kouluyhteisössä koronaepidemian aikana: Ensitulokset* [Schoolgoing, teaching, and well-being in school communities during the COVID-19 pandemic: Primary results]. Helsinki: University of Helsinki. Accessed February 12, 2021. https://tuhat.helsinki.fi/ws/portalfiles/portal/141903720/Raportti_ensituloksista_elokuu_2020.pdf.

Alanen, Riikka. 2011. "Kysely tutkijan työkaluna" [Questionnaire as a researcher's tool]. In *Kieltä tutkimassa: Tutkielman laatijan opas* [Conducting research on a language: A guide for the thesis writer], edited by Paula Kalaja, Riikka Alanen, and Hannele Dufva, 146–161. Tampere: Finn Lectura.

Alharbi, Abdullah Abdul Muhsen. 2020. "The Degree of Teaching Knowledge for Saudi EFL Teachers: An Investigation for Madinah EFL Teachers' Perceptions Regarding TPACK Framework." *English Language Teaching* 13, no. 10: 99–110. Accessed February 11, 2021. DOI: 10.5539/elt.v13n10p99.

Angeli, Charoula, Nicos Valanides, and Andri Christodoulou. 2016. "Theoretical Considerations of Technological Pedagogical Content Knowledge." In *Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators*, edited by Mary C. Herring, Matthew J. Koehler, and Punya Mishra, 11–32. London: Routledge.

Antikainen, Ari, Risto Rinne, and Leena Koski. 2013. *Kasvatussosiologia* [Sociology of eduation]. Jyväskylä: PS-kustannus.

Archambault, Leanna M, and Joshua H. Barnett. 2010. "Revisiting technological pedagogical content knowledge: Exploring the TPACK framework." *Computers & Education* 55, no. 4: 1656–1662.

Asetus opetustoimen henkilöstön kelpoisuusvaatimuksista [Decree on Qualification Requirements for Teaching Staff] 1998/986. https://www.finlex.fi/fi/laki/ajantasa/1998/19980986#L3P5. Accessed February 6, 2021.

Baser, Derya, Theodore J. Kopcha, and M. Yasar Ozden. [2015] 2016. "Developing a technological pedagogical content knowledge (TPACK) assessment for preservice teachers learning to teach English as a foreign language." *Computer Assisted Language Learning* 29 no. 4: 749–764.

Brantley-Dias, Laurie, and Peggy A. Ertmer. 2013. "Goldilocks and TPACK: Is the Construct "Just Right?"" *Journal of Research on Technology in Education* 46 no. 2: 103–128. Accessed February 6, 2021. DOI: 10.1080/15391523.2013.10782615.

Camilleri, Mark Anthony, and Adriana Camilleri. 2016. "Digital Learning Resources and Ubiquitous Technologies in Education." *Technology, Knowledge and Learning* 22, no. 1: 65–82. Accessed December 6, 2020. DOI: 10.1007/s10758-016-9287-7.

Chai, Ching Sing, Joyce Hwee Ling Koh, and Chin-Chung Tsai. 2016. "A Review of the Quantitative Measures of Technological Pedagogical Content Knowledge (TPACK)" In *Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators*, edited by Mary C. Herring, Matthew J. Koehler, and Punya Mishra, 87–106. London: Routledge.

Davies, Graham. 2009. “New technologies and language learning: a suitable subject for research?” In *Computer Assisted Language Learning*, edited by Philip Hubbard, 265–279. New York: Routledge.

Dörnyei, Zoltan. 2007. *Research Methods in Applied Linguistics: Quantitative, Qualitative, and Mixed Methodologies*. Oxford: Oxford University Press.

Dörnyei, Zoltan, and Tatsuya Taguchi. 2010. *Questionnaires in Second Language Research: Construction, Administration, and Processing*. 2nd ed. New York: Routledge.

Education Statistics Finland. n.d. *Educational structure of the population*. Accessed December 25, 2020. https://vipunen.fi/en-gb/structures/Pages/V%C3%A4est%C3%B6n-koulutusrakenne.aspx.

Fathi, Jalil, and Saman Yousefifard. 2018. “Assessing Language Teachers’ Technological Pedagogical Content Knowledge (TPACK): EFL Students’ Perspectives.” *Research in English Language Pedagogy (RELP)* 7, no. 2: 255–282. Accessed February 6, 2021. DOI: 10.30486/relp.2019.665888.

The Federation of Foreign Language Teachers in Finland (SUKOL). n.d. *Tilastotietoa kielivalinnoista* [Statistics on language choices]. Accessed February 7, 2021. https://www.sukol.fi/liitto/uutiset/tilastotietoa/tilastotietoa_kielivalinnoista.

Ferri, Fernando, Patrizia Grifoni, and Tiziana Guzzo. 2020. “Online Learning and Emergency Remote Teaching: Opportunities and Challenges in Emergency Situations” *Societies* 10, no. 4: 86. Accessed February 11, 2021. DOI: 10.3390/soc10040086.

Finnish Education Evaluation Centre. 2020. *Korona-aika on haastanut kouluja ja oppilaitoksia kehittämään uusia hyviä käytänteitä* [The coronavirus situation has challenged schools and educational institutions to look for useful new practices]. Accessed December 28, 2020. https://karvi.fi/2020/11/17/korona-aika-on-haastanut-kouluja-ja-oppilaitoksia-kehittamaan-uusia-hyvia-kaytanteita/.

Finnish Ministry of Education and Culture. n.d.-a. *Extension of compulsory education*. Accessed March 30, 2021. https://minedu.fi/en/extension-of-compulsory-education.

Finnish Ministry of Education and Culture. n.d.-b. *Finnish Education System*. Accessed December 3, 2020. https://minedu.fi/en/education-system.

Finnish National Agency for Education. 2019. *Perusopetuksen opetussuunnitelman perusteiden 2014 muutokset ja täydennykset koskien A1-kielen opetusta vuosiluokilla 1-2* [Changes and additions to the teaching of an A1 language in grades 1-2 in the National Core Curriculum for Basic Education]. Helsinki: Opetushallitus.

Finnish National Agency for Education. n.d. *Perusopetuksen opetussuunnitelman ydinasiat* [The Key Issues in the National Core Curriculum for Basic Education]. Accessed December 25, 2020. https://www.oph.fi/fi/koulutus-ja-tutkinnot/perusopetuksen-opetussuunnitelman-ydinasiat.

Finnish National Board of Education. 2016. *National Core Curriculum for Basic Education 2014*. Helsinki: Finnish National Board of Education.

Hautamäki, Jarkko, and Helena Thuneberg. 2019. “Koulutuksen tasa-arvotaseet [Equity balances in education]” In *Perusopetus, tasa-arvo ja oppimaan oppiminen: Valtakunnallinen arviointitutkimus peruskoulun päättövaiheesta* [Comprehensive education, equality, and learning to learn: Nationwide evaluative research on the final phase of comprehensive education], edited by Jarkko Hautamäki, Irene Rämä, and Mari-Pauliina Vainikainen, 77–96. Helsinki: University of Helsinki.

Hew, Khe Foon, and Thomas Brush. 2007. "Integrating technology into K-12 teaching and learning: Current knowledge." *Educational Technology Research and Development* 55, no. 3: 223–252. Accessed February 25, 2021. DOI: 10.1007/s11423-006-9022-5.

Hodges, Charles, Stephanie Moore, Barb Lockee, Torrey Trust, and Aaron Bond. 2020. *The Difference Between Emergency Remote Teaching and Online Learning*. Accessed February 12, 2021. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning.

Hsu, Liwei. 2016. "Examining EFL teachers' technological pedagogical content knowledge and the adoption of mobile-assisted language learning: a partial least square approach." *Computer Assisted Language Learning* 29, no. 8: 1287–1297. Accessed February 11, 2021. DOI: 10.1080/09588221.2016.1278024.

Iwaniec, Janina. 2019. "Questionnaires: Implications for effective implementations" in *The Routledge Handbook of Research Methods in Applied Linguistics*, edited by Jim McKinley and Heath Rose, 324–335. London: Routledge.

Kabakci Yurdakul, Isil, Hatice Ferhan Odabasi, Kerem Kilicer, Ahmet Naci Coklar, Gurkay Birinci, and Adile Askim Kurt. 2012. "The development, validity and reliability of TPACK-deep: A technological pedagogical content knowledge scale." *Computers & Education* 58, no. 3: 964–977. Accessed February 25, 2021. DOI: 10.1016/j.compedu.2011.10.012.

Kalenius, Aleksi. 2020. *Are We There Yet? Equality of learning opportunity in theory and practice*. Helsinki: University of Helsinki. Accessed February 7, 2021. http://urn.fi/URN:ISBN:978-951-51-6156-7.

Koehler, Matthew J., and Punya Mishra. 2005. "What happens when teachers design educational technology? The development of technological pedagogical content knowledge." *Journal of Educational Computing Research* 32, no. 2: 131–152.

———. 2008. "Introducing TPCK." In *Handbook of Technological Pedagogical Content Knowledge (TPKC) For Educators*, edited by AACTE Committee on Innovation and Technology, 3–29. New York: Routledge.

———. 2009. "What Is Technological Pedagogical Content Knowledge?" *Contemporary Issues in Technology and Teacher Education* 9, no. 1: 60–70.

Koehler, Matthew J., Tae Seob Shin, and Punya Mishra. 2012. "How Do We Measure TPACK? Let Me Count the Ways." In *Educational Technology, Teacher Knowledge, and Classroom Impact: A Research Handbook on Frameworks and Approaches*, edited by Robert N. Ronau, Christopher R. Rakes, and Margaret L. Niess, 16–31. Hershey, PA: IGI Global.

Korkeakoski, Markus. 2019. "Digitalisaatio peruskoulussa. Opettajien kokemuksia Varsinais-Suomen alueelta [Digitalization in Comprehensive Education. Teachers' Experiences from Southwest Finland]." MA Thesis, University of Turku. Accessed December 25, 2020. http://urn.fi/URN:NBN:fi-fe2019052817611.

Kozikoğlu, İshak, and Nuri Babacan. 2019. "The investigation of the relationship between Turkish EFL teachers'technological pedagogical content knowledge skills and attitudes towards technology." *Journal of Language and Linguistic Studies* 15, no. 1: 20–33. Accessed February 11, 2021. DOI: 10.17263/jlls.547594.

Kyllönen, Mari. 2020. *Teknologian pedagoginen käyttö ja hyväksyminen : opettajien digipedagoginen osaaminen* [The pedagogical use and acceptance of technology : teachers' digipedagogical skills]. Jyväskylä: University of Jyväskylä.

Lawrence, Geoff. 2018. “The Role of Language Teacher Beliefs in an Increasingly Digitalized Communicative World.” In *Handbook of Research on Integrating Technology Into Contemporary Language Learning and Teaching*, edited by Bin Zou and Michael Thomas, 140–160. Hershey, PA: IGI Global.

Ling Koh, Joyce Hwee, Ching Sing Chai, and Lee Yong Tay. 2014. “TPACK-in-Action: Unpacking the contextual influences of teachers' construction of technological pedagogical content knowledge (TPACK)” *Computers & Education* 78, September 2014: 20–29. Accessed February 25, 2021. DOI: 10.1016/j.compedu.2014.04.022.

Loima, Jyrki. 2020. “Socio-Educational Policies and Covid-19 – A Case Study on Finland and Sweden in the Spring 2020.” *Journal of Education & Literacy Studies* 8, no. 3: 59–75. Accessed February 12, 2021. DOI: 10.7575/aiac.ijels.v.8n.3p.59.

McEwan, Hunter, and Barry Bull. 1991. “The Pedagogic Nature of Subject Matter Knowledge.” *American Educational Research Journal* 28, no. 2: 316–34. Accessed February 21, 2021. DOI: 10.2307/1162943.

Mishra, Punya, and Matthew J. Koehler. 2006. “Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge.” *Teachers College Record* 108, no. 6: 1017–1054.

Mukminin, Amirul, Akhmad Habibi, and Fridiyanto. 2020. “Technology in the classroom: EFL teachers’ technological pedagogical and content knowledge.” *Informatologia* 53, no. 1: 24–36. Accessed February 11, 2021. DOI: 10.32914/i.53.1-2.3.

National Research Council. 1999. *Being fluent with information technology literacy. Computer science and telecommunications board commission on physical sciences, mathematics, and applications*. Washington, DC: National Academy Press.

Nazari, Naghmeh, Zohreh Nafissi, Masoomeh Estaji, and S. Susan Marandi. 2019. “Evaluating novice and experienced EFL teachers’ perceived TPACK for their professional development.” *Cogent Education* 6, no. 1: 1–26. Accessed February 11, 2021. DOI: 10.1080/2331186X.2019.1632010.

Niemi, Hannele Marjatta, and Päivi Kousa. 2020. “A Case Study of Students’ and Teachers’ Perceptions in a Finnish High School during the COVID Pandemic.” *International Journal of Technology in Education and Science (IJTES)* 4, no. 4: 352–369. Accessed February 12, 2021. DOI: 10.46328/ijtes.v4i4.167.

Niess, Margaret L. 2017. *Technological Pedagogical Content Knowledge (TPACK) Framework for K-12 Teacher Preparation: Emerging Research and Opportunities*. Hershey, PA: IGI Global.

OECD. 2016. *PISA 2015 Results (Volume I): Excellence and Equity in Education*. Paris: OECD Publishing. Accessed February 7, 2021. DOI: 10.1787/9789264266490-en.

Rahimi, Mehrak, and Shakiba Pourshahbaz. 2019. *English as a Foreign Language Teachers' TPACK: Emerging Research and Opportunities*. Hershey, PA: IGI Global.

Redmond, Petrea, and Yehuda Peled. [2018] 2019. “Exploring TPACK among pre-service teachers in Australia and Israel.” *British Journal of Educational Technology* 50, no. 4: 2040–2054. Accessed 6 February 2021. DOI: 10.1111/bjet.12707.

Rose, Heath, Jim McKinley, and Jessica Briggs Baffoe-Djan. 2020. *Data Collection Research Methods in Applied Linguistics*. London: Bloomsbury Academic.

Saubern, Ralph, Michael Henderson, Eva Heinrich, and Petrea Redmond. 2020. “TPACK – time to reboot?” *Australasian Journal of Educational Technology* 36, no. 3: 1–9. Accessed February 21, 2021. DOI: 10.14742/ajet.6378.

Scherer, Ronny, Jo Tondeur, and Fazilat Siddiq. 2017. "On the quest for validity: Testing the factor structure and measurement invariance of the technology-dimensions in the Technological, Pedagogical, and Content Knowledge (TPACK) model." *Coputers & Education* 112: 1–17. Accessed February 6, 2021. DOI: 10.1016/j.compedu.2017.04.012.

Schmidt, Denise A., Evrim Baran, Ann D. Thompson, Punya Mishra, Matthew J. Koehler, and Tae S. Shin. 2009. "Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice Teachers." *Journal of Research on Technology in Education* 42, no. 2: 123–149. Accessed February 4, 2021. DOI: 10.1080/15391523.2009.10782544.

Schulman, Lee S. 1987. "Knowledge and Teaching: Foundations of the New Reform." *Harvard Educational Review* 57, no. 1: 1–22.

Scott, Kristin C. 2021. "A Review of Faculty Self-Assessment TPACK Instruments (January 2006 – March 2020)" *International Journal of Information and Communication Technology Education* 17, no. 2: 118–137. Accessed February 6, 2021. DOI: 10.4018/IJICTE.2021040108.

Shinas, Valerie Harlow, Sule Yilmaz-Ozden, Chrystalla Mouza, Rachel Karchmer-Klein, and Joseph J. Glutting. [2013] 2014. "Examining Domains of Technological Pedagogical Content Knowledge Using Factor Analysis." *Journal of Research on Technology in Education* 45, no. 4: 339–360. Accessed February 4, 2021. DOI: 10.1080/15391523.2013.10782609.

Taipale, Paula. 2021. "Finnish Primary Teacher's Experiences of Remote Teaching during COVID-19 School Closures." MA Thesis, University of Turku. Accessed February 11, 2021. http://urn.fi/URN:NBN:fi-fe202102094233.

Tanhua-Piiroinen, Erika, Suvi-Sadetta Kaarakainen, Meri-Tuulia Kaarakainen, and Jarmo Viteli. 2020. *Digiajan peruskoulu II* [Comprehensive Schools in the Digital Age II]. Opetus- ja kulttuuriministeriön julkaisuja 2020:17. Accessed December 27, 2020. http://urn.fi/URN:ISBN:978-952-263-823-6.

Tanhua-Piiroinen, Erika, Suvi-Sadetta Kaarakainen, Meri-Tuulia Kaarakainen, Jarmo Viteli, Antti Syvänen, and Antero Kivinen. 2019. *Digiajan peruskoulu* [Comprehensive Schools in the Digital Age]. Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 6/2019. Accessed December 27, 2020. http://urn.fi/URN:ISBN:978-952-287-634-8.

Tseng, Jun-Jie, Ching Sing Chai, Lynde Tan, and Moonyoung Park. 2020. "A critical review of research on technological pedagogical and content knowledge (TPACK) in language teaching." *Computer Assisted Language Learning* ahead-of-print: 1–24. Accessed February 25, 2021. DOI: 10.1080/09588221.2020.1868531.

Tuomi, Jouni, and Anneli Sarajärvi. 2009. *Laadullinen tutkimus ja sisällönanalyysi* [Qualitative research and content analysis]. 6th ed. Helsinki: Tammi.

University of Turku. 2020. *Alustavien tutkimustulosten mukaan etäopiskelu korona-aikana oli oppilaille vaativaa* [Preliminary results indicate distance learning during the coronavirus situation was demanding for students]. Accessed December 28, 2020. https://www.utu.fi/fi/ajankohtaista/uutinen/alustavien-tutkimustulosten-mukaan-etaopiskelu-korona-aikana-oli-oppilaille.

Uusisalmi, Riitta. 2017. “Teknologisoituva koulu: Toimijaverkostoteoreettinen analyysi teknologisten laitteiden vaikutuksista peruskoulun tasa-arvoon [Technologization in schools: An actor–network theoretical study on the effects of technological devices on equality in comprehensive education].” MA Thesis, University of Lapland. Accessed February 7, 2021. http://urn.fi/URN:NBN:fi:ula-201710111339.

van der Vlies, Reyer. 2020. *Digital strategies in education across OECD countries: Exploring education policies on digital technologies*. OECD Education Working Papers No. 226. Accessed December 25, 2020. DOI: 10.1787/33dd4c26-en.

van Driel, Jan H., Nico Verloop, and Wobbe de Vos. 1998. “Developing science teachers' pedagogical content knowledge.” *Journal of Research in Science Teaching* 35, no. 6: 673–695. Accessed February 7, 2021. DOI: 10.1002/(SICI)1098-2736(199808)35:6<673::AID-TEA5>3.0.CO;2-J.

Willermark, Sara. 2018. “Technological Pedagogical and Content Knowledge: A Review of Empirical Studies Published From 2011 to 2016.” *Journal of Educational Computing Research* 56, no. 3: 315–343. Accessed February 6, 2021. DOI: 10.1177/0735633117713114.

Wu, Ying-Tien, and Amber Yayin Wang. 2015. “Technological, Pedagogical, and Content Knowledge in Teaching English as a Foreign Language: Representation of Primary Teachers of English in Taiwan.” *The Asia - Pacific Education Researcher* 24, no. 3: 525–533. Accessed February 11, 2021. DOI: 10.1007/s40299-015-0240-7.

**Appendix 1** Questionnaire

# Kysely englanninopettajien teknologis-pedagogisista taidoista

Tämä kysely on osa Turun yliopistossa tehtävää pro gradu -tutkielmaa. Kyselyn tarkoituksena on kartoittaa, millaisiksi suomalaisissa oppilaitoksissa työskentelevät englanninopettajat kokevat teknologis-pedagogiset taitonsa. Lisäksi kyselyssä selvitetään, miten opettajat arvioivat COVID-19-virustilanteesta aiheutuneen etäopetukseen siirtymisen vaikuttaneen tieto- ja viestintäteknologisiin taitoihinsa.

Kysely perustuu Koehlerin & Mishran (2006) kehittämään teknologis-pedagogisen sisältötiedon teoriaan (Technological Pedagogical Content Knowledge, TPACK).

Kyselyyn vastaaminen kestää n. 15 minuuttia.

Kiitos ajastasi ja arvokkaista vastauksistasi!

## TIETOSUOJAILMOITUS TUTKIMUKSEEN OSALLISTUVALLE

**25.8.2020**

Tietosuojailmoitus on toimitettu suoraan tutkittavalle.

**Antamiani tietoja ja vastauksia saa käyttää anonyymisti tämän tutkimuksen aineistona ***

- ○ Kyllä
- ○ Ei

## Taustatiedot

Tähdellä merkityt kysymykset ovat pakollisia.

**Koulutustausta ***

Valitse vähintään yksi

- [ ] Aineenopettaja
- [ ] Luokanopettaja
- [ ] Muu, mikä?

**Ikä ***

- ○ Alle 30 vuotta
- ○ 30-39 vuotta
- ○ 40-49 vuotta
- ○ 50-59 vuotta
- ○ 60 vuotta tai enemmän

**Opetuskokemus vuosina ***

- ○ Alle 5 vuotta
- ○ 5-10 vuotta
- ○ 11-20 vuotta
- ○ 21-30 vuotta
- ○ Yli 30 vuotta

**Kouluaste, jolla opetan ***

Valitse enintään kaksi ensisijaisinta

- [ ] Alakoulu
- [ ] Yläkoulu
- [ ] Lukio
- [ ] Ammattioppilaitos
- [ ] Korkeakoulu
- [ ] Vapaan sivistystyön oppilaitos

**Muut opettamani aineet**

Jos opetat pelkästään englantia, siirry seuraavalle sivulle

- [ ] espanja
- [ ] ranska
- [ ] ruotsi
- [ ] saksa
- [ ] venäjä
- [ ] Muu, mikä?

## Teknologisten laitteiden saatavuus opetuksessa

**Opetuksessa käytettävissäni ovat seuraavat teknologiset laitteet ***

Valitse vähintään yksi

- [ ] (Kannettava) tietokone
- [ ] Dokumenttikamera
- [ ] Videotykki/projektori
- [ ] Älytaulu
- [ ] Tabletti
- [ ] Älypuhelin
- [ ] Muu, mikä?

**Oppilailla/opiskelijoilla on englannintunneilla käytettävissään teknologisia laitteita seuraavasti ***

- ○ Jokaisella henkilökohtaisessa käytössä kannettava tai tabletti jokaisella tunnilla
- ○ Jokaisella henkilökohtaisessa käytössä kannettava tai tabletti toisinaan
- ○ Ryhmän kesken yhteiskäytössä kannettavia tai tabletteja jokaisella tunnilla
- ○ Ryhmän kesken yhteiskäytössä kannettavia tai tabletteja toisinaan
- ○ Oppilailla/opiskelijoilla ei ole käytettävissä kannettavia tai tabletteja

**+ Kuinka usein laitteita on käytettävissä?**

- ○ Kerran viikossa
- ○ Kerran kahdessa viikossa
- ○ Kerran kuukaudessa
- ○ Harvemmin

**+ Kuinka monta laitetta ryhmällä on käytettävissä?**

- ○ Yksi laite joka toisella oppilaalla/opiskelijalla
- ○ Yksi laite harvemmalla kuin joka toisella oppilaalla/opiskelijalla

Kyselyn varsinaisessa osiossa on 30 väittämää. Vastaa väittämiin sen perusteella, kuinka hyvin ne kuvaavat sinua tai taitojasi. Oikeita tai vääriä vastauksia ei ole.

Väittämät on jaettu viiteen osioon:

Teknologinen tieto

Pedagoginen tieto

Pedagoginen sisältötieto

Teknologis-pedagoginen tieto

Teknologis-pedagoginen sisältötieto

Tähdellä merkityt väittämät ovat pakollisia.

**Teknologinen tieto (Technological Knowledge, TK)**

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 1. Tunnen tavallisimmat teknologiset käsitteet (esim. käyttöjärjestelmä, langaton liittymä ym.) ja osaan käyttää niitä tarkoituksenmukaisesti. * | ○ | ○ | ○ | ○ | ○ |
| 2. Osaan mukauttaa tietokoneen omaan käyttööni sopivaksi esimerkiksi asentamalla siihen ohjelmia ja yhdistämällä sen internetiin. * | ○ | ○ | ○ | ○ | ○ |
| 3. Osaan käyttää tietokoneen oheislaitteita, kuten tulostinta, kuulokkeita ja skanneria. * | ○ | ○ | ○ | ○ | ○ |
| 4. Osaan tehdä yleisimmät tietokoneen käyttöön liittyvät vianmääritykset itsenäisesti (esim. ongelmat tulostimen tai internetyhteyden kanssa; engl. *troubleshooting*). * | ○ | ○ | ○ | ○ | ○ |
| 5. Osaan käyttää luokkahuoneessa olevia digitaalisia laitteita, kuten videotykkiä ja smart boardia. * | ○ | ○ | ○ | ○ | ○ |
| 6. Minulla on hyvät taidot Microsoft Office -ohjelmien käytössä (Word, PowerPoint jne.) * | ○ | ○ | ○ | ○ | ○ |
| 7. Osaan luoda multimediasisältöjä (esim. videoita tai nettisivuja) käyttäen tekstiä, kuvia, ääntä, videoklippejä ja animaatioita. * | ○ | ○ | ○ | ○ | ○ |
| 8. Osaan käyttää yhteistyötä tukevia ohjelmistotyökaluja (esim. wikiä, Edmodoa tai 3D-virtuaaliympäristöjä; engl. *collaboration tools*) tavoitteideni mukaisesti. * | ○ | ○ | ○ | ○ | ○ |
| 9. Minun on helppo oppia käyttämään teknologisia sovelluksia, jotka helpottavat/tehostavat työskentelyäni. * | ○ | ○ | ○ | ○ | ○ |

**Pedagoginen tieto (Pedagogical knowledge, PK)**

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 10. Osaan käyttää eri oppimisympäristöihin sopivia opetusmenetelmiä ja -tekniikoita. * | ○ | ○ | ○ | ○ | ○ |
| 11. Osaan huomioida oppilaiden/opiskelijoiden tason opetusta suunnitellessani. * | ○ | ○ | ○ | ○ | ○ |
| 12. Osaan tukea oppilaiden/opiskelijoiden oppimista huomioiden heidän yksilölliset eronsa. * | ○ | ○ | ○ | ○ | ○ |
| 13. Teen yhteistyötä koulutyön osapuolten kanssa (oppilaiden/opiskelijoiden, vanhempien, muiden opettajien jne.; engl. *school stakeholders*) tukeakseni oppilaiden/opiskelijoiden oppimista. * | ○ | ○ | ○ | ○ | ○ |
| 14. Osaan soveltaa erilaisissa koulutuksissa oppimiani tietoja ja taitoja omassa opetuksessani. * | ○ | ○ | ○ | ○ | ○ |
| 15. Osaan tukea oppilaiden/opiskelijoiden luokan ulkopuolista työskentelyä edistääkseni heidän itseohjautuvaa oppimistaan. * | ○ | ○ | ○ | ○ | ○ |

**Pedagoginen sisältötieto (Pedagogical content knowledge, PCK)**

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 16. Minulla on hyvät ryhmänhallintataidot. * | ○ | ○ | ○ | ○ | ○ |
| 17. Osaan arvioida oppilaiden/opiskelijoiden oppimisprosesseja. * | ○ | ○ | ○ | ○ | ○ |

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 18. Osaan käyttää sellaisia opetusmentelmiä ja -tekniikoita, jotka tukevat oppilaiden/opiskelijoiden kielitaidon kehitystä. * | | | | | |
| 19. Osaan valita oppitunnilla tehtävät harjoitukset sen mukaan, mikä parhaiten edistää tunnin tavoitteen saavuttamista. * | | | | | |
| 20. Osaan suunnitella oppitunnit oppilaiden/opiskelijoiden kielitaitotasolle sopiviksi. * | | | | | |

**Teknologis-pedagoginen tieto (Technological pedagogical knowledge, TPK)**

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 21. Osaan hyödyntää tieto- ja viestintäteknologiaa opetuksen eriyttämisessä. * | | | | | |
| 22. Osaan opastaa oppilaita/opiskelijoita käyttämään tieto- ja viestintäteknologiaa laillisesti, eettisesti ja turvallisesti sekä huomioimaan tekijänoikeudet. * | | | | | |
| 23. Osaan tukea oppilaita/opiskelijoita teknologian käytössä niin, että heidän kriittinen ajattelunsa ja ongelmanratkaisukykynsä kehittyvät. * | | | | | |
| 24. Teknologian käyttö oppitunneilla ei heikennä ryhmänhallintataitojani. * | | | | | |

**Teknologis-pedagoginen sisältötieto (Technological pedagogical content knowledge, TPACK)**

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 25. Osaan arvioida, onko teknologian käyttö tarkoituksenmukaista tietyn asian tai kokonaisuuden opettamisessa. * | ○ | ○ | ○ | ○ | ○ |
| 26. Osaan suunnitella kielenoppimista tukevaa oppimateriaalia tai harjoituksia erilaisten teknologioiden avulla. * | ○ | ○ | ○ | ○ | ○ |
| 27. Osaan hyödyntää multimediasisältöjä, kuten videoita ja nettisivuja, oppilaiden/opiskelijoiden kielenoppimisen tukena. * | ○ | ○ | ○ | ○ | ○ |
| 28. Osaan käyttää yhteistyötä tukevia ohjelmistotyökaluja (esim. wikiä, Edmodoa tai 3D-virtuaaliympäristöjä; engl. *collaboration tools*) oppilaiden/opiskelijoiden kielenoppimista edistävällä tavalla. * | ○ | ○ | ○ | ○ | ○ |
| 29. Osaan tukea oppilaita/opiskelijoita heidän käyttäessään teknologiaa itsenäisesti kielen oppimisen tukena. * | ○ | ○ | ○ | ○ | ○ |
| 30. Pystyn hyödyntämään teknologisia työkaluja ja resursseja kehittyäkseni ammatillisesti ja kehittääkseni opetustani. * | ○ | ○ | ○ | ○ | ○ |

Viimeisen osion tarkoituksena on kartoittaa englanninopettajien näkemyksiä siitä, kuinka keväällä 2020 tapahtunut pakollinen siirtyminen etäopetukseen on vaikuttanut heidän tieto- ja viestintäteknologisiin taitoihinsa (jäljempänä myös *tvt-taidot*).

Vastaa kysymyksiin sen perusteella, kuinka hyvin ne kuvaavat sinun tilannettasi ja kokemustasi. Oikeita ja vääriä vastauksia ei ole.

**Vaikuttiko keväällä 2020 tapahtunut etäopetusjakso tieto- ja viestintäteknologisiin taitoihisi? ***

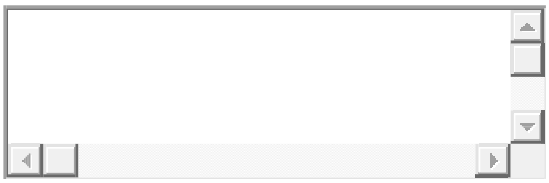
- ○ Kyllä
- ○ Ei

**+ Miten koet taitojesi muuttuneen etäopetuksen myötä?**

- Taitoni huononivat
- Taitoni paranivat

**+ Miten koet tvt-taitojesi huonontuneen?**

Voit myös kertoa muista etäopetusjakson vaikutuksista tvt-taitoihisi.



**+ Miten tieto- ja viestintäteknologiset taitosi paranivat?**

Vastaa väittämiin sen perusteella, kuinka hyvin ne kuvaavat kokemustasi etäopetuksesta.

| | Täysin eri mieltä | Jokseenkin eri mieltä | Ei samaa eikä eri mieltä | Jokseenkin samaa mieltä | Täysin samaa mieltä |
|---|---|---|---|---|---|
| 1. Teknologian käytöstä tuli yleisesti sujuvampaa | ○ | ○ | ○ | ○ | ○ |
| 2. Opin käyttämään videopuhelusovelluksia tai -ohjelmia opetuksen järjestämisessä (esim. Zoom, Teams) | ○ | ○ | ○ | ○ | ○ |
| 3. Opin käyttämään muita uusia sovelluksia tai ohjelmia opetuksessa (mitä?) | ○ | ○ | ○ | ○ | ○ |
| 4. Opin arvioimaan teknologian käytön tarkoituksenmukaisuutta opetuksessa | ○ | ○ | ○ | ○ | ○ |
| 5. Opin hyödyntämään teknologiaa opetuksen arvioinnissa | ○ | ○ | ○ | ○ | ○ |

**+ Paranivatko tvt-taitosi muilla kuin yllä mainituilla tavoilla?**

Voit myös kertoa omin sanoin etäopetusjakson vaikutuksista tvt-taitoihisi.

**Avoin palaute/kommentit kyselystä (vapaaehtoinen)**

Kiitos vastauksistasi ja onnea uuteen lukuvuoteen!

**Appendix 2** Translated Questionnaire

UNIVERSITY OF TURKU

# Survey on English teachers' technological pedagogical skills

This survey is part of a master's being done at the University of Turku. The aim of the survey is to map out how English teachers in Finnish schools perceive their technological pedagogical skills. In addition, the survey investigates how teachers think that the period of remote teaching due to the COVID-19 pandemic affected their information and communication technology (ICT) skills.

The survey is based on the framework of Technological Pedagogical Content Knowledge (TPACK), developed by Koehler & Mishra (2006).

It takes about 15 minutes to complete the survey.

Thank you for your time and your valuable answers!

## PRIVACY NOTICE FOR THE PARTICIPANTS

### 25 August 2020

The privacy notice has been delivered directly to the participant.

I accept that the information and responses provided by me can be used anonymously as data in this study *****

- Yes
- No

## Background information

Questions marked with an asterisk are compulsory.

**Educational background ***

Please choose at least one

- [ ] Subject teacher
- [ ] Classroom teacher
- [ ] Other please specify

**Age ***

- ○ Under 30 years
- ○ 30 to 39 years
- ○ 40 to 49 years
- ○ 50 to 59 years
- ○ 60 years or older

**Teaching experience in years ***

- ○ Less than 5 years
- ○ 5 to 10 years
- ○ 11 to 20 years
- ○ 21 to 30 years
- ○ Over 30 years

**Level of education at which I teach ***

Please choose no more than two primary ones

- [ ] Elementary school
- [ ] Middle school
- [ ] General upper secondary school
- [ ] Vocational upper secondary school
- [ ] Higher education
- [ ] Liberal adult education

**Other subjects taught by me**

If you teach English only, please continue to the next page

- [ ] French
- [ ] German
- [ ] Russian
- [ ] Spanish
- [ ] Swedish
- [ ] Other, please specify

## Access to technological devices in teaching

**While teaching, I have access to following technological devices ***

Please choose at least one

- [ ] Laptop or computer
- [ ] Document camera
- [ ] Video projector
- [ ] Smart board
- [ ] Tablet
- [ ] Smart phone
- [ ] Other, please specify

**During English lessons, pupils/students have access to following technological devices ***

- ○ Each pupil/student has a laptop or a tablet in personal use on every lesson
- ○ Each pupil/student has a laptop or a tablet in personal use on some lessons
- ○ Laptops or tablets in joint use on every lesson
- ○ Laptops or tablets in joint use on every lesson
- ○ Pupils/students do not have access to laptops or tablets

**+ How often are the devices available?**

- ○ Once a week
- ○ Once every two weeks
- ○ Once a month
- ○ Less than once a month

**+ How many devices are in joint use?**

- ○ One device per every other pupil/student
- ○ One device per fewer than every other pupil/student

The main part of the survey consists of 30 statements. Please react to the statements based on how well they describe you or your skills. There are no right or wrong answers.
The statements are divided into five sections:
Technological knowledge
Pedagogical knowledge
Pedagogical content knowledge
Technological pedagogical knowledge
Technological pedagogical content knowledge

**Technological Knowledge, TK**

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 1 I can use basic technological terms (e.g. operating system, wireless connection, virtual memory, etc.) appropriately. * | ○ | ○ | ○ | ○ | ○ |
| 2 I can adjust computer settings such as installing software and establishing an Internet connection. * | ○ | ○ | ○ | ○ | ○ |
| 3 I can use computer peripherals such as a printer, a headphone, and a scanner. * | ○ | ○ | ○ | ○ | ○ |
| 4 I can troubleshoot common computer problems (e.g. printer problems, Internet connection problems, etc.) independently. * | ○ | ○ | ○ | ○ | ○ |
| 5 I can use digital classroom equipment such as projectors and smart boards. * | ○ | ○ | ○ | ○ | ○ |
| 6 I can use Office programs (i.e. Word, PowerPoint, etc.) with a high level of proficiency. * | ○ | ○ | ○ | ○ | ○ |
| 7 I can create multimedia (e.g. video, web pages, etc.) using text, pictures, sound, video, and animation. * | ○ | ○ | ○ | ○ | ○ |
| 8 I can use collaboration tools (wiki, edmodo, 3D virtual environments, etc.) in accordance with my objectives. * | ○ | ○ | ○ | ○ | ○ |

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 9 I can learn software that helps me complete a variety of tasks more efficiently. * | | | | | |

**Pedagogical knowledge, PK**

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 10 I can use teaching methods and techniques that are appropriate for a learning environment. * | | | | | |
| 11 I can design a learning experience that is appropriate for the level of students. * | | | | | |
| 12 I can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences. * | | | | | |
| 13 I can collaborate with school stakeholders (students, parents, teachers, etc.) to support students' learning. * | | | | | |
| 14 I can reflect the experiences that I gain from professional development programs to my teaching process. * | | | | | |
| 15 I can support students' out-of-class work to facilitate their selfregulated learning. * | | | | | |

**Pedagogical content knowledge, PCK**

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 16 I can manage a classroom learning environment. * | | | | | |
| 17 I can evaluate students' learning processes. * | | | | | |
| 18 I can use appropriate teaching methods and techniques to support students in developing their language skills. * | | | | | |
| 19 I can prepare curricular activities that develop students' language skills. * | | | | | |
| 20 I can adapt a lesson plan in accordance with students' language skill levels. * | | | | | |

**Technological pedagogical knowledge, TPK**

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 21 I can meet students' individualized needs by using information technologies. * | | | | | |
| 22 I can lead students to use information technologies legally, ethically, safely, and with respect to copyrights. * | | | | | |
| 23 I can support students as they use technology such as virtual discussion platforms to develop their higher order thinking abilities. * | | | | | |

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 24 I can manage the classroom learning environment while using technology in the class. * | | | | | |

**Technological pedagogical content knowledge, TPACK**

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 25 I can decide when technology would benefit my teaching of specific English curricular standards. * | | | | | |
| 26 I can design learning materials by using technology that supports students' language learning. * | | | | | |
| 27 I can use multimedia such as videos and websites to support students' language learning. * | | | | | |
| 28 I can use collaboration tools (e.g. wiki, 3D virtual environments, etc.) to support students' language learning. * | | | | | |
| 29 I can support students as they use technology to support their development of language skills in an independent manner. * | | | | | |
| 30 I can support my professional development by using technological tools and resources to continuously improve the language teaching process. * | | | | | |

The aim of this last section is to map English teachers' opinions on how they think that the period of remote teaching in spring 2020 affected their information and communication technology (ICT) skills.
Please answer the questions based on how well they describe your situation and your experiences. There are no right or wrong answers.

**Did the period of remote teaching in spring 2020 affect your ICT skills? ***

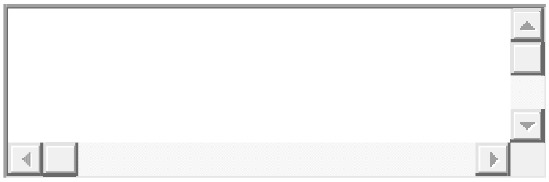
- Yes
- No

**+ How do you think your skills were affected?**

- My skills decreased
- My skills increased

**+ How do you think your skills decreased?**

You can also explain in your own words what effects remote teaching had on your ICT skills.



**+ How did your ICT skills increase?**

Please respond to the statements according to how well they describe your experience of remote teaching.

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 1 Using technology became more effortless in general. | | | | | |
| 2 I learned how to use videotelephony software programs or applications (such as Zoom or Teams) in teaching. | | | | | |

| | Completely disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Completely agree |
|---|---|---|---|---|---|
| 3 I learned how to use other new programs or applications in teaching (please specify?) | | | | | |
| 4 I learned how to evaluate when using technology in teaching suits the purpose. | | | | | |
| 5 I learned how to utilize technology in assessing students' learning. | | | | | |

**+ Did your ICT skills improve in other ways than the ones mentioned above?**

You can also explain in your own words what effects remote teaching had on your ICT skills.

Feedback/comments on the survey (optional)

Thank you for your answers and good luck with the upcoming school year!

**Appendix 3** Finnish summary

## Johdanto

Kuten kaikkien aineiden opettajilta, myös kieltenopettajalta vaaditaan useita taitoja. Pedagogisen osaamisen ja oman aineensa asiantuntijuuden lisäksi 2020-luvun opettajien tulee yhä enenevissä määrin kyetä hyödyntää opetuksessaan erilaisia teknologioita. Esimerkiksi Suomessa vuodesta 2016 alkaen voimassa ollut perusopetuksen opetussuunnitelma painottaa oppilaiden tieto- ja viestintäteknologisten taitojen kehitystä ja sitä kautta teknologian käyttöä opetuksessa edeltäjiään voimakkaammin, mikä on tuonut uusia haasteita myös opettajien työhön. Tähän mennessä toteutetuissa tutkimuksissa on havaittu, että opetussuunnitelmassa säädetyt tavoitteet teknologian käytöstä toteutuvat vaihtelevasti; ei ainoastaan siksi, että koulujen resursseissa on huomattavia eroja, vaan myös opettajien vaihtelevien teknologisten taitojen takia (Tanhua-Piiroinen ym. 2020, 38–39, 45).

Teknologian yhdistäminen opetukseen ei ole yksinkertaista, sillä tarkoituksenmukainen ja tehokas teknologian käyttö opetuksessa vaatii opettajalta monenlaisia taitoja (Niess 2017, 1–2). Näin ollen pelkkä teknologisten laitteiden saatavuus ei takaa niiden menestyksellistä hyödyntämistä (Mishra & Koehler 2006, 1018–1019). Eräs harvoista teorioista, jotka keskittyvät määrittelemään ja tutkimaan opettajan teknologiaa hyödyntävässä opetuksessa tarvitsemia tietoja ja taitoja, on teknologis-pedagogisen sisältötiedon teoria (Technological Pedagogical Content Knowledge, lyhyemmin TPACK). TPACK-teoriaa on sen ensiaskelista lähtien käytetty valtavasti opettajien teknologiatietämyksen tutkimisessa, mutta Suomessa teoria ei toistaiseksi ole saanut samanlaista suosiota kuin esimerkiksi Aasian maissa. Tutkimuskentässä on selkeä aukko erityisesti suomalaisten englanninopettajien teknologiatietämyksen osalta.

Opetussuunnitelman asettamien teknologiatavoitteiden ja toisaalta tutkimuskentässä olevan aukon perusteella tässä tutkielmassa pyritäänkin kartoittamaan suomalaisten englanninopettajien teknologis-pedagogista sisältötietämystä TPACK-teorian avulla. Tutkimusaiheen tärkeyttä lisää entisestään keväällä 2020 koronapandemian takia tapahtunut siirtyminen etäopetukseen, joka haastoi niin suomalaisten kuin muidenkin maiden opettajien teknologiset taidot ennen-näkemättömällä tavalla. Tutkielman tutkimuskysymykset on asetettu seuraavasti:

1. Millaiseksi suomalaiset englanninopettajat arvioivat oman teknologis-pedagogisen sisältötietämyksensä (TPACK)?
2. Millaisia eroja koetun teknologis-pedagogisen sisältötietämyksen tasossa on eri-ikäisten opettajien välillä tai opettajien opetuskokemuksen perusteella?
3. Miten englanninopettajat kokivat keväällä 2020 koronapandemiasta aiheutuneen etäopetusjakson vaikuttaneen heidän tvt-taitoihinsa ja sitä kautta teknologis-pedagogiseen sisältötietämykseensä?

## Teoreettinen viitekehys

Tutkielman teoreettisena viitekehyksenä toimii jo mainittu TPACK-teoria. Tutkielmassa tarkoitetaan *teknologialla* aiemman TPACK-tutkimuksen mukaisesti digitaalisia teknologioita ja erityisesti tieto- ja viestintäteknologioita (tvt). *Teknologisilla taidoilla* viitataan selkeyden vuoksi pelkkään taiton käyttää teknologisia laitteita ottamatta välttämättä huomioon pedagogiikkaa ja opetettavaa sisältöä, jotka teknologis-pedagogisessa sisältötietämyksessä ovat yhtä merkittävässä osassa kuin teknologia.

Yksinkertaisesti määriteltynä teknologis-pedagogisella sisältötietämyksellä tarkoitetaan kaikkien niiden taitojen muodostamaa kokonaisuutta, joita opettaja tarvitsee hyödyntääkseen teknologiaa opetuksessa tehokkaasti ja tarkoituksenmukaisesti (Angeli, Valanides & Christodoulou 2016, 11). TPACK perustuu Lee Schulmanin 1980-luvulla kehittämään pedagogisen sisältötiedon teoriaan (Pedagogical Content Knowledge, lyhyemmin PCK), joka pyrki kuvailemaan opettajan kykyä muuntaa tuntemansa oppisisältö pedagogisesti sopivaan muotoon (Schulman 1987, 8). Seuraavan vuosikymmenen aikana suuren suosion saavuttanut teoria laajeni vuonna 2005, kun Koehler & Mishra lisäsivät yhtälöön teknologian, kehittäen TPACK-teorian. Teorian ytimessä on käsitys siitä, että teknologian hyödyntäminen opetuksessa tehokkaasti ja tarkoituksenmukaisesti ei riipu vain saatavilla olevista laitteista ja opettajien teknologisista taidoista, vaan vaatii opettajalta kokonaisvaltaisempaa ja moniulotteisempaa tietämystä myös pedagogiikasta ja opetettavasta sisällöstä (Koehler & Mishra 2009, 62).

TPACK-teorian ytimessä ovat edellä mainitut kolme tietämystyyppiä: sisältötieto (Content Knowledge, CK), pedagogiikka (Pedagogical Knowledge, PK) ja teknologia (Technological Knowledge, TK). Yhtä tärkeää on kuitenkin ymmärtää ja tutkia myös näiden tietämysten välisiä suhteita, joita kuvataan termeillä teknologinen sisältötieto (TCK), teknologispedagoginen tieto (TPK), pedagoginen sisältötieto (PCK) ja teknologis-pedagoginen sisältötieto (TPACK) (Koehler & Mishra 2009, 63). Teknologian integroiminen opetukseen onnistuu luontevasti ja tehokkaasti, kun opettaja hallitsee kunkin tietämysalueen ja osaa soveltaa niiden välisiä suhteita kuhunkin opetustilanteeseen sopivaksi. Koehler & Mishra (2009, 66) ovatkin sitä mieltä, että TPACK-teoriassa kuvattu tietämys on kaiken tehokkaasti ja tarkoituksenmukaisesti teknologiaa hyödyntävän opetuksen taustalla.

Opettajien teknologis-pedagogista sisältötietoa on tutkittu ja mitattu monella tavalla. Kvantitatiivisista menetelmistä erityisesti opettajien itsearviointiin perustuvia kyselytutkimuksia on käytetty runsaasti TPACK-tutkimuksessa. Englanninopettajien TPACK on herättänyt kiinnostusta erityisesti Aasian ja Lähi-idän maissa: korkeimpia tuloksia on saatu Taiwanissa, jossa Wu & Wang (2015) ja Hsu (2016) havaitsivat opettajien eri tietämystyyppien tuntemuksen olevan keskimäärin 5/7 ja joillakin osa-alueilla jopa 6/7. Hieman matalampia keskiarvoja on mitattu Saudi-Arabiassa ja Turkissa, joissa englanninopettajien tulokset kaikissa tietämystyypeissä ovat olleet likimain 3.5/5 (Kozikoğlu & Babacan 2019; Alharbi 2020). Huomattavasti matalampaa teknologiatietämystä on havaittu indonesialaisilla englanninopettajilla, joiden teknologisen sisältötiedon ja teknologis-pedagogisen sisältötiedon tasoksi Mukminin, Habibi & Fridiyanto (2020) mittasivat keskimäärin noin 2/5. Teknologiaan liittymättömillä pedagogisen tiedon, sisältötiedon ja pedagogisen sisältötiedon osa-alueilla tulokset olivat lähempänä muiden maiden tasoa ollen likimain 3.5/5 (ibid.). Lisäksi Iranissa Nazari ym. (2019) vertailivat aloittelevien ja kokeneiden englanninopettajien TPACK-tasoja havaiten selkeitä eroja ryhmien välillä. Kokemattomammilla englanninopettajilla havaittiin nimittäin olevan kokeneita kollegoitaan parempi tietämys kaikilla teknologiaan liittyvillä osa-alueilla, kun taas kokeneiden opettajien pedagogisen tiedon ja pedagogisen sisältötiedon taso oli selkeästi aloittelevampia opettajia parempi. On kuitenkin huomioitava, että teknologiaan liittyvien osa-alueiden tietämys oli kohtuullisen alhainen myös aloittelevilla opettajilla, joiden

keskimääräinen tulos TPACK-osa-alueelta oli 8.2/36 eli selkeästi alle käytetyn skaalan puolivälin.

Koska tutkimuksen kohteena ovat suomalaiset englanninopettajat, on tarpeen käsitellä lyhyesti myös teknologian roolia Suomen koulujärjestelmässä. Kuten mainittu, nykyinen perusopetuksen opetussuunnitelma painottaa oppilaiden tvt-taitojen kehittämistä läpi koulutaipaleen vaatien uudenlaisia taitoja myös opettajilta. Tvt-taidot ovat yksi laaja-alaisen osaamisen seitsemästä osa-alueesta, ja niiden hyödyntäminen on mainittu myös vieraiden kielten oppiaineen tehtävissä jokaisella opetusasteella (Finnish National Agency for Education 2016, 136, 236, 375). Käytännössä teknologiaa käytetään opetuksessa kuitenkin vaihtelevasti, mikä johtuu osittain opettajien eritasoisista taidoista teknologian hyödyntämisessä (Tanhua-Piiroinen ym. 2020, 38–39). Tuoreimpien ja kattavimpien tutkimustulosten mukaan noin puolet suomalaisista opettajista kokee teknologiset taitonsa perustasoisiksi, kun taas noin 10 % kokee taitojensa olevan puutteelliset (Tanhua-Piiroinen ym. 2020, 63–64). Toisaalta loput pitävät taitojaan joko kehittyneinä pedagogisina taitoina tai toimivat jopa vertaistukena tai tvt-asiantuntijana omassa työyhteisössään (ibid.). Nuorempien opettajien teknologiset taidot on myös havaittu iäkkäämpiä kollegoitaan paremmiksi (Korkeakoski 2019, 66–67; Tanhua-Piiroinen ym. 2020, 70), ja opettajat toivovat yhä lisää koulutusta teknologian käytössä ja erityisesti digitaalisten sisältöjen luomisessa (Tanhua-Piiroinen ym. 2020, 83–84).

Tutkielmassa kartoitetaan lisäksi myös englanninopettajien kokemuksia kevään 2020 etäopetuksen vaikutuksesta heidän tvt-taitoihinsa. Poikkeusolojen vaikutuksista ei vielä ole julkaistu kattavasti tutkimustuloksia, mutta alustavien tulosten mukaan etäopetus sujui suomalaisissa kouluissa hyvin ja vaikutti etenkin opettajien teknologiseen osaamiseen merkittävästi (Ahtiainen ym. 2020; Loima 2020, 6). Opettajat vaikuttavat omaksuneen uusienkin teknologioiden käytön nopeasti (Niemi & Kousa 2020, 352), ja kehittyneet teknologiataidot mainitaan usein yhtenä etäopetusjakson positiivisimmista vaikutuksista (Taipale 2021, 41). Alustavien tulosten mukaan jopa 94 % opettajista koki etäopetusjakson vaikuttaneen teknologisiin taitoihinsa ainakin jossain määrin (Ahtiainen ym. 2020, 17).

## Aineisto ja menetelmät

Tutkimuksen aineisto kerättiin Webropol-verkkoalustan avulla toteutetulla kyselylomakkeella. Kyselyssä oli yhteensä 30 TPACK-väittämää, jotka perustuivat Bazerin, Kopchan ja Ozdenin (2016) kehittämään kysymyspatteristoon. Lisäksi kysyttiin taustatietoja, kuten ikä, opetuskokemus, koulutustausta, opetettavat aineet ja kouluaste sekä teknologian saatavuus opetuksessa. Tutkielman rajallisen laajuuden vuoksi taustakysymyksistä ei kuitenkaan hyödynnetty varsinaisessa tutkimuksessa kuin iän ja opetuskokemuksen osalta. Kyselyn lopuksi vastaajilta kysyttiin, kokivatko he etäopetusjakson vaikuttaneen tvt-taitoihinsa, minkä jälkeen he saivat halutessaan jakaa kokemuksiaan omin sanoin.

Aineisto analysoitiin kvantitatiivisin menetelmin hyödyntäen SPSS-tilastoanalyysiohjelmaa. Analyysissä hyödynnettiin ensisijaisesti deskriptiivisiä eli kuvailevia tilastollisia menetelmiä, joiden avulla saatiin esille aineiston tunnusluvut, kuten keskiarvo ja keskihajonta. Ryhmien välisessä vertailussa hyödynnettiin ei-parametrisia Kruskal-Wallis- ja Mann-Whitney U -testejä, koska kerätty aineisto ei noudattanut normaalijakaumaa. Etäopetusjaksoa koskevat avoimet vastaukset luokiteltiin teemoittain, ja havaintojen frekvenssit analysoitiin siltä osin kuin ne koskivat etäopetuksen vaikutusta tvt-taitoihin.

## Tutkimustulokset

Tulosten perusteella voidaan todeta, että kyselyyn vastanneiden suomalaisten englanninopettajien taso on tasaisen korkea kaikissa TPACK-tietotyypeissä. Korkeimmat keskiarvot havaittiin pedagogisen sisältötiedon, pedagogisen tiedon ja teknologisen tiedon osa-alueilla (KA=4.11/4.11/4.26, KH=0.50/0.49/0.54). Muusta aineistosta poikkeavan matalat keskiarvot (3.35, 2.49 ja 2.61) koskivat opettajien arviota kyvystään luoda multimediasisältöjä (esim. videoita) sekä käyttää yhteistyötä tukevia työkaluja (engl. *collaboration tools*).

Vastaajien TPACK-tasossa havaittiin hienoisia eroja eri ikäryhmien ja eri pituisten opetuskokemusten perusteella, mutta erojen ei havaittu olevan tilastollisesti merkittäviä ($p<0.05$). Erot mukailivat kuitenkin aiemmassa tutkimuksessa saavutettuja tuloksia, joiden

mukaan nuoremmilla ja kokemattomammilla opettajilla on keskimäärin paremmat teknologiset taidot kuin vanhemmilla ja kokeneemmilla kollegoillaan (Korkeakoski 2019, 66–67; Nazari ym. 2019; Tanhua-Piiroinen ym. 2020, 70), kun taas kokeneemmilla opettajilla on keskimäärin aloittelevia paremmat taidot pedagogiseen ja sisältötietoon liittyvillä osa-alueilla (Nazari ym. 2019).

Tuloksista voitiin lisäksi havaita suurimman osan osallistujista (80 %) kokeneen etäopetusjakson parantaneen heidän tvt-taitojaan. Jäljelle jäävän viidesosan kohdalla etäopetusjakso ei kohentanut tvt-taitoja todennäköisesti siksi, että taidot olivat tällä ryhmällä jo entuudestaan merkittävästi korkeammat kuin muilla vastaajilla. Tutkimuksen perusteella ei voida varmuudella sanoa, kuinka suuri muutos opettajien tvt-taidoissa on etäopetusjakson aikana tapahtunut, mutta nyt saadut tulokset olisivat todennäköisesti olleet ainakin jossain määrin matalammat, jos tutkimus olisi toteutettu ennen koronaviruksen aiheuttamaa etäopetusjaksoa. Opettajien kokemukset etäopetuksen tvt-taitoja edistävästä vaikutuksesta mukailevat tähän asti julkaistuja tutkimustuloksia (Ahtiainen ym. 2020, 17; Taipale 2021, 41), joskin niiden opettajien, jotka eivät kokeneet etäopetuksen kehittäneen heidän taitojaan, osuus tähän tutkielmaan vastanneista on merkittävästi suurempi kuin muissa tutkimuksissa.

## Päätelmät

Tulosten perusteella voidaan todeta, että suomalaisten englanninopettajien teknologiaa hyödyntävässä opetuksessa tarvitseman tietämyksen taso on korkea kaikilla mitatuilla TPACK-tietämysalueilla. Tulokset eivät kuitenkaan ole yleistettävissä koko Suomen englanninopettajapopulaatioon, minkä vuoksi niiden varmistamiseksi suositellaan kattavampaa lisätutkimusta. Opettajien tietämystasossa havaittiin lisäksi vain hienoisia eroja ikäryhmien ja opetuskokemusten perusteella muodostettujen ryhmien välillä, jotka voisivat mahdollisesti tulla selkeämmin esiin nykyistä laajemmalla ja edustavammalla otannalla. Eroja eri-ikäisten ja kokemukseltaan eritasoisten opettajien tietämystasoissa on havaittu aiemmissa TPACK-tutkimuksissa (Nazari ym. 2019) sekä Suomessa toteutetuissa opettajien teknologisia taitoja koskevissa tutkimuksissa (Korkeakoski 2019, Tanhua-Piiroinen ym. 2020), minkä vuoksi niiden tutkiminen laajemmassa mittakaavassa on perusteltua.

Vaikka tulosten perusteella voidaan päätellä ainakin kyselyyn vastanneiden englanninopettajien tietämyksen olevan korkealla tasolla, niiden perusteella ei kuitenkaan vielä voida tietää, kuinka teknologian käyttö sujuu opettajilta käytännössä ja kuinka paljon teknologiaa he todellisuudessa hyödyntävät opetuksessaan. Tietämyksen lisäksi olisikin mielenkiintoista ja opetussuunnitelmakeskustelun kannalta tärkeää selvittää opettajien todellisia taitoja ja teknologian käyttöä sekä verrata tuloksia heidän kokemaansa tietämystasoon. TPACK-aiheisen tutkimuksen uskotaan sen vuoksi lisääntyvän tulevaisuudessa myös Suomessa, jossa teknologian käyttö opetuksessa on noussut aiempaa merkittävämpään rooliin viimeisen viiden vuoden aikana.