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Unravelling Pre-Service EFL Teachers' WPACK and CDL Levels for Their Professional Development through Technology Acceptance

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Abstract

Training pre-service teachers has become more important with the significant changes in the utilization of educational technologies in the 21st century. That said, educators are now expected to be digitally literate, capable of accepting and using new technologies by employing skills in the use of web tools. Accordingly, this quantitatively driven research investigates pre-service English as a Foreign Language (EFL) teachers' levels of web-pedagogical content knowledge (WPACK) together with critical digital literacy (CDL) in order to address technology acceptance in teaching and learning practices. In doing so, 94 pre-service EFL teachers are recruited from the department of English Language Teaching at a state university in Türkiye during 2020-21 academic year. The results have showed that pre-service EFL teachers' levels of CDL are moderately high where their levels of WPACK are even higher, albeit with no significance regarding gender, age and personal computer ownership. To note, pedagogical implications and further recommendations are listed to better understand their technology adoption.

Keywords: *Pre-Service Teachers, Web Pedagogical Content Knowledge, Critical Digital Literacy, Technology Adoption, WPACK, CDL, EFL.*

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Introduction

Since the turn of the 20th century, there has been a huge transformation in people's lives due to the flood of technical advancements in the information age. One of the most notable changes brought about by these advancements was the introduction of educational technologies (EdTechs), which required a review of previous teaching strategies, resources, professional development for teachers, and teacher education. As a result, one of the responsibilities of the educators was noted as the dissemination of information via technology. As more recent technological advancements proliferated, the criteria for teachers to successfully incorporate technology into their instruction grew more stringent. As a result, educational pedagogy asked the query "What makes a competent teacher for this century?"

To explain and build upon the earlier research and paradigms to find answers to this question, a wide variety of frameworks, methodologies, pedagogies, and ideas were put forth. Teachers were viewed as being essential to the success of technology integration in the classroom, therefore even those that were developed and used in other disciplines were changed and adapted into educational pedagogy (Teo, 2011), bringing out a gap in literature. Some researchers concentrated on the skills and knowledge teachers needed for successful technology integration (Angeli & Valanides, 2008; Mishra & Koehler, 2006; Shulman, 1986), whereas others sought to understand the factors that affected individuals to choose to use a specific technology (Davis, 1985; Davis et al., 1989; Davis, 1993; Venkatesh & Davis, 1996; Venkatesh, 2000; Venkatesh & Davis, 2000, Venkatesh et al., 2003, Venkatesh & Bala, 2008, Venkatesh, et al., 2012).

More contemporary ones dealt with the acceptability of technology; thus, teachers' knowledge popped up as a research field across multiple contexts and disciplines. Regarding the importance of technology in teaching, authorities and other institutions did, however, generally agree. That was why there were so many technological advancements around the turn of the 20th century, which led to the underlying idea that a life without technology was becoming increasingly difficult. As a result, it changed how humans might act, think, and live as well as the adoption of technology for education like other scientific disciplines (Rahimi & Pourshahbaz, 2018).

One of the opportunities provided by these technologies was the ability to use online tools to quickly and easily access digital material on the Internet. Therefore, the term "literacy" acquired significance in the 21th century, emphasizing that it did not only refer to the ability to read and write but also to use modern technologies (European Commission, 2007). Drawing interest from the research communities, the effective use of technologies in education across a variety of disciplines has been a focus of research such as the examination of teachers' knowledge, technology acceptance, and digital literacies with the notion that instruction without technical resources might be less effective (Ertmer & Ottenbreit-Leftwich, 2010).

Beyond question, language education is one of the fields emphasizing the importance of using meaningful technologies in an effective way by both teachers and students. In this point, the phrase "computer assisted language learning" (CALL) refers to a language learning procedure

where students use computers to increase their language ability (Beatty, 2004). The term "computer" in this definition encompasses all forms of technology that can be used in teaching and learning, albeit not electrical devices. Therefore, it is recognised that the proper use of digital technologies in language education can facilitate learners' language learning processes by improving their critical thinking and problem-solving abilities (Blake, 2013). Therefore, it is necessary to investigate pre-service language teachers' technology acceptance, their knowledge of technology integration, and their critical digital literacy skills to give teacher educators and other authorities a valuable insight into how to prepare teachers for teaching second/foreign languages in the age of technology since according to UNESCO (2005), teacher education programs "serve as key change agents in transforming education and society" (p. 12). It is also noteworthy to mention that pre-service teacher education programs choose to develop teachers' knowledge of technology integration because it is noted in the literature that teachers' prior knowledge may influence their future teaching (Bransford & Schwartz, 1999). This also allows teachers to effectively integrate technology into their lessons (Mishra & Koehler, 2006). Additionally, engagement with native speakers of the target language is also cited as a crucial component of language teaching since it caters for authentic language interaction; as a result, the adequate and effective use of web technologies by teachers is acknowledged as a crucial research area (Hew & Brush, 2007). Besides, according to the U.S. Department of Education (USDOE, 2003), "technology is now considered by most educators and parents to be a vital part of providing a high-quality education" regarding the educational setting" (p. 3), and it is decided that teachers are the main transmitters of technology integration in the classroom (Teo, 2014).

Furthermore, the use of web-based technologies in language education may significantly advance learning since it fosters interactivity in the target language and supports systems focused on interaction (e.g., remote learning). As a result, given that we live in a digital age, the advantages and disadvantages of using innovative technologies in education are unquestionable (Instance & Kools, 2013). As it has been noted, students are more motivated when the lessons are enhanced with technology since sharing, collaboration, and expression are reinforced by web-based digital technologies, such as blogs, YouTube, and other social media platforms. In that, the diversity of educational technologies may offer numerous opportunities for teachers' professional development and support the teaching and learning process.

However, innovative educational technologies face an obstacle in that there is no guarantee that they will be successfully incorporated into pre-service teachers' lessons in the future. Despite being considered "digital natives," today's teachers may not fully appear to understand the fundamentals of using digital tools. Although pre-service teachers in the present day are proficient in communication and the use of online interaction technologies, it is also mentioned that there is a continuous concern regarding the appropriate integration of technologies in teaching (Lei, 2009; Ma et al., 2005). The fact that effective use of digital and web tools in teaching context is not guaranteed by a stand-alone technology or methodology course in teacher education is confirmed when pre-service teachers state that they do not feel ready for technology integration in their future teaching even after taking a methodology course (Tondeur et al., 2012), which may highlight the fact that stand-alone technology or methodology courses in

teacher education may not be completely sufficient (Buss et al., 2015); consequently, there has been a growing need for the exploration of driving factors beneath technology adoption through different types of knowledge and skills.

Herein to note, by the Web Pedagogical Content Knowledge Framework (WPACK) by Lee and Tsai (2010) together with the framework titled "The Five Resources of Critical Digital Literacy: A Framework for Curriculum Integration" developed by Hinrichsen and Coombs (2013) made up the background since knowledge types that a teacher was assumed to possess should not be ill defined. Therefore, Pedagogical Content Knowledge (PCK) framework of Shulman (1986) and Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006) were combined to create the first framework, WPACK, then developed by Lee and Tsai (2010). The PCK framework developed by Shulman focused on the connections between a teacher's subject-matter expertise and pedagogical knowledge and attempted to explain how teachers create and modify preparatory themes or topics that were suited to the interests and aptitudes of their students.

In essence, following the reform of educational technology at the start of the 21st century, it was decided that "technical knowledge" should also be included in the categories of knowledge that a teacher should possess, leading some scholars to propose TPACK (Angeli & Valanides, 2009; Mishra & Koehler, 2006). Accordingly, the technological knowledge in the framework would not be sufficient to represent the web knowledge itself because the characteristics and attributes of web tools differed from the use of educational technologies and the use of certification programs. As the inclusion of several web tools in education gained importance over time as a result of the emergence of multiple web tools and the proliferation of Internet in our daily lives. Thus, they suggested the WPACK framework, which included four knowledge bodies—Web Knowledge (WK), Web Pedagogical Knowledge (WPK), Web Content Knowledge (WCK), and WPACK—along with three knowledge regions known as "content," "pedagogy," and "web."

On the other hand, the necessity of critical examination of digital tools in the 21st century and the value placed on digital literacies led to the concept of critical digital literacy (CDL) emerging. As a result, the concept of CDL developed from Gilster's (1997) idea of "digital literacy" and took on multiple meanings in various contexts. Hinrichsen and Coombs (2013), who were motivated by the CDL model of Freebody and Luke (1990), certified the latest of these definitions and frameworks. Accordingly, decoding, meaning making, using, and analysis were listed as the first four CDL resources in their framework, which further expanded the model by adding a fifth resource called "persona". In the framework, they also noted that it was not a brand-new model that was unaffected by earlier frameworks and hypotheses, but rather a kind of compilation and evaluation of earlier studies in place of the changed and adapted notions.

Since in the 21st century, teacher education has become increasingly concerned with the question of what supports pre-service teachers' effective and appropriate use of technology in their instruction, there is a need for studies that explain and analyse these briefly aforementioned concepts—WPACK, and CDL—of pre-service EFL teachers because they can offer new

perspectives on the variables that influence future technology integration and the appropriate use of digital technologies in teaching languages. So, the main goal is to explore the interplay between Turkish pre-service EFL teachers' levels of WPACK and CDL as well as how these frameworks interact with one another with regard to certain variables. Accordingly, this research addresses the following research questions:

1. What are the Turkish pre-service EFL teachers' levels of WPACK and CDL?
    a. Is there a statistically significant difference of WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of age?
    b. Is there a statistically significant difference of WPACK, and CDL levels of Turkish pre-service EFL teachers in terms of gender?
    c. Is there a statistically significant difference of WPACK, and CDL levels Turkish pre-service EFL teachers in terms of owning a personal computer?
2. Is there a relationship between WPACK and CDL levels of Turkish pre-service EFL teachers?

In order to seek answers to these questions, first, the concepts of teacher knowledge for a better understanding of WPACK, and the notion behind CDL are elaborated below in detail.

Teacher Knowledge

The topic of "What defines teacher knowledge?" has become so prominent that it may serve as the catalyst for an efficient technology integration in education as the research focus in educational technologies has gravitated towards the use of effective technological tools by teachers. As a result, since the turn of the 20th century, relevant studies have increasingly focused on the information that teachers possess.

Accordingly, Shulman (1986) introduced Pedagogical Content Knowledge (PCK) which integrates content and pedagogy to be able to uncover how peculiar subjects, topics or problems are constructed, and adapted to learners' divergent interests and abilities in depth. He explained this dichotomy as "the ways of representing and formulating the subject that make it comprehensible to others." (p. 9). PCK basically represents an amalgam of Content Knowledge (CK) and Pedagogical Knowledge (PK). The main objective of Shulman (1987) was to understand how teachers are "being able to comprehend subject matter for themselves, become able to elucidate subject matter in new ways, reorganize and partition it, clothe it in activities and emotions, in metaphors and exercises, and in examples and demonstrations so that it can be grasped by the students" (p. 13).

Shulman (1986) categorized the professional knowledge bases of a teacher as 'content knowledge', 'general pedagogical knowledge', 'curriculum knowledge', and 'pedagogical content knowledge'. According to this categorization, a teacher's CK consisted of 'subject matter content knowledge', 'pedagogical content knowledge', and 'curricular knowledge'. The curricular knowledge included two types of knowledge, namely, 'lateral curriculum knowledge' and 'vertical curriculum knowledge'. The definitions of these knowledge bodies are as follows:

a. "Subject Matter Content Knowledge; the amount and organization of knowledge per se in

the mind of the teacher which requires going beyond knowledge of the facts or concepts of a domain,

b. Pedagogical Content Knowledge; the form of content knowledge that embodies the aspects of content most germane to its teachability which goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching,

c. Curricular Knowledge; the curriculum and its associated materials are the materia-medica of pedagogy, the pharmacopeia from which the teacher draws those tools of teaching that present or exemplify content and remediate or evaluate the adequacy of student accomplishment,

d. Lateral Curriculum Knowledge; the teacher's ability to relate the content of a given course or lesson to topics or issues being discussed simultaneously in other classes,

e. Vertical Curriculum Knowledge; familiarity with the topics and issues that have been and will be taught in the same subject area during the preceding and later years in school, and the materials that embody them" (Shulman, 1986, p. 9-11).

In addition to this conceptualization, Shulman (1987) added three more types of knowledge to the teacher knowledge base, which were 'knowledge of learners and their characteristics', 'knowledge of educational context', and 'knowledge of educational ends, purposes and values and their philosophical and historical grounds'. Regarding these three types of knowledge forming the base of a teacher's knowledge, Shulman (1987) proposed the term 'case knowledge' which came into play when teacher was dealing with these types of knowledge in several contexts. Case knowledge referred to knowledge of the specific events occurring in educational contexts and included three subcategories of cases: prototypes, precedents and parables:

a. "Prototypes; examples of theoretical principles,

b. Precedents; communication of principles of practice or maxims,

c. Parables; transmission of norms or values" (Schulman, 1987, p. 11).

Lastly, Shulman (1987) added 'strategic knowledge' to the framework as a third body of knowledge which he referred as the type of knowledge necessary for teachers to deal with problems in relation with the crash of moral values, principles, or other situations. The definitions of teachers' knowledge, especially PCK, had numerous extensions and recategorizations in literature on the grounds that it was too narrow to be applied and adapted.

For instance, Grossman (1990) commented on PCK as the representations of six subject matters and the ways of teachers' dealing with the content-related difficulties faced in the teaching environment in addition to the knowledge of specific curriculum and content related areas. Marks (1990) extended the framework of Shulman (1986) and introduced the 'knowledge of media' which went beyond subject matter knowledge per se by asserting that the development of PCK was actualized through the integration of subject matter knowledge and general

pedagogical knowledge. Cochran, DeRuiter, and King (1993) suggested an extension of Shulman's (1986) PCK framework from a constructivist perspective, and they renamed the construct as 'Pedagogical Content Knowing' (PCKg) emphasizing the dynamic essence of the construct. They defined PCKg as "a teacher's integrated understanding of four components of pedagogy, subject matter content, student characteristics, and the environmental context of learning" (Cochran et al., 1993, p. 266). Following this, Fernandez-Balboa and Stiehl (1995) introduced the knowledge of a teacher consisting of five knowledge components which were 'subject matter knowledge', 'knowledge of students', 'knowledge of instructional strategies', 'knowledge of teaching context', and 'purposes of teaching'.

In 1999, a distinction of transformative and integrative view of teacher knowledge was represented by Gess-Newsome. The Shulman's (1986) PCK was claimed to be a transformative claiming that it was a unique body of knowledge possessed by teachers while integrative view presenting PCK as an amalgam of subject matter knowledge, pedagogical knowledge, and context knowledge rather than viewing PCK as an independent construct. Consequently, the extension of the Shulman's (1986) framework and addition of new categories of knowledge types were mostly under the influence of his original framework. The classification system of Borko and Putnam (1996) was an example of this. They renamed the Shulman's (1986) original categories and proposed them as 'general pedagogical knowledge', 'knowledge and beliefs about subject matter', and 'pedagogical content knowledge and beliefs'. The PCK view of Margerum-Leys and Marx (2002) was prominent in literature in that it stressed the significance of PK being not specific solely to the use of technologies but encompassing broader strategies to scaffold, monitor and motivate learners. They also claimed that PCK was a body of knowledge derived from educational technologies yet being applicable to teaching and learning with educational technology.

The numerous and various conceptualizations of PCK reveals the principle of 'fit for purpose' implying that it is suitable to be modified and adapted. The formulation of PCK has paved the way for future research on teacher knowledge in literature. The advancements in technology in the beginning of the 21st century have altered the way of teaching; thus, leading to scrutiny of how teachers have dealt with educational technologies. Consequently, knowledge of technologies has come into prominence since technological innovations and advancements have ruled educational settings including the ways teachers teach and students learn. On this regard, the scholars have proposed that the knowledge a teacher possesses should include 'technological knowledge' as well giving rise to the emergence of 'Technological Pedagogical Content Knowledge' (TPACK) paradigm (Angeli & Valanides, 2008; Mishra & Koehler, 2006).

The mindset of Mishra and Koehler (2006) was that they considered technology as a knowledge system of several biases and facilities pointing the changing applicability of it in some cases. They summarized what they aimed at proposing this framework as followed (Mishra & Koehler, 2006):

> "*Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts*

> *and requires developing a sensitivity to the dynamic, transactional relationship between all three components suggested by the TPCK framework*" (p. 134).

Koehler and Mishra (2009) also pointed out that teacher education in developing TPACK was of critical importance since raising teachers with high level of TPACK in the future to shape the TPACK framework representing a growing body of research in teacher education, teacher professional development, and teachers' use of technology. Besides, they added that TPACK also allowed teachers, researchers, and teacher educators to extend their approaches, run counter to the view of technology as an "add-on" construct in education and adapt more ecological view towards it.

Besides, the scrutinization of TPACK and delineation of consisting knowledge bodies' interaction with one another became the focal point of teacher knowledge and education. Following the proposal of TPACK framework by Mishra and Koehler (2006), Angeli and Valanides (2008) proposed another framework suggesting that TPACK was a distinct and a unique body of knowledge promoted by the interactions between its components, and they named their framework as Information and Communication Technologies-TPCK (ICT-TPCK) signifying the importance of technology. They adopted a transformative view and asserted that the reason why the TPACK framework was required to be viewed from this perspective was that it necessitated the transformation of five knowledge bodies into a unique body of knowledge involving the component knowledge bodies' interactions (Angeli & Valanides, 2008).

This conceptualization of Angeli and Valanides (2009) ran counter to the idea that technology was a vehicle to transmit information, and it foregrounded the significance of technology as a cognitive tool enhancing students' learning (Angeli & Valanides, 2008). The ICT-TPCK was at odds with Mishra and Koehler's TPCK (2006) framework in that ICT-TPCK highlighted the view that the growth and development of a knowledge body component per se did not guarantee the growth in the other knowledge bodies, and a change in one of these knowledge bodies might not be compensated by none of the others. This view pointed out the focus on TPCK as a unique body of knowledge rather than treating it with its knowledge domains separately. Lastly, Angeli and Valanides (2008) stressed that ICT–TPCK development attempts could be built upon socio-cognitive constructivist ideas since constructing cognitive and socio-cognitive conflicts and stimulating meaning negotiation among students with different conceptions were the most effective transformations of the content. Among all these assertions, there were some other scholars (e.g., Cox & Graham, 2009; Niess, 2005) conforming the hypothesis of Angeli and Valanides (2008) which was regarded as an extension of Shulman's (1987) PCK framework. Finally, the most prevalent one was Mishra and Koehler's (2009) view pointing that TPACK was the interaction and inter-junction of three knowledge bodies within a specific context.

As the delivery of the content and the ubiquitous application of numerous web tools in educational technologies have gained prominence, the technology and web usage have differed in time. Hereby, Lee and Tsai (2010) have expressed that web tools should be distinguished as a separate technology per se in modern education and TPACK would be inappropriate and

insufficient to incorporate all the web technologies utilized in the educational technologies. Thus, they have suggested this new framework labelled "Web Pedagogical Content Knowledge" (WPACK) which has contravened the view that the web knowledge teachers possess can be subsumed under the category of technology knowledge.

Web-Pedagogical Content Knowledge

Having a greater insight into the educational technologies and the role of teachers, new resources of information and communication have arisen, which also gives rise to various modes of teaching such as synchronous, asynchronous, collaborative, and autonomous learning making Internet and web-based tools the focal point of educational technologies (Neo, 2003). Yet, Internet has been regarded as a means rather than the essential point of education, or even sometimes as a toy (Tsai & Lin, 2004). However, the inclusion of web technologies in teacher education programs has debunked the significance of web tools since TPACK is asserted not to be sufficient to provide an insight into teacher education.

It is also highlighted that web is a momentous requisite in modern education and the evaluation of teacher knowledge including web technologies under the TPACK framework is incompetent in providing information that can reinforce the professional development of teachers and the teacher training programs (Lee & Tsai, 2010). Thus, Lee and Tsai (2010) have introduced the WPACK framework, also named as TPCK-W, to examine teacher knowledge with respect to web-based instruction and have suggested that teachers need to combine their web knowledge with PCK for teaching with web. Their framework consists of three areas of knowledge, namely, 'content', 'pedagogy' and 'web', and is composed of four knowledge bodies, Web Knowledge (WK), Web Pedagogical Knowledge (WPK), Web Content Knowledge (WCK) and Web Pedagogical Content Knowledge (WPCK) (Lee & Tsai, 2010).

In the framework, 'web' encompasses not only the knowledge about web tools but also the progressive knowledge required for web-based interaction and web-based communication. The conjunction of 'web' and 'content' generates WCK which refers to the system of connecting the benefits and attributes of web with content. Another conjunction of the framework, namely the overlap of 'web' and 'pedagogy' forms WPK which highlights the elements of web and the skills of teachers to be utilized in teaching with web (Akar, 2019). The framework also underlines the interaction amidst these knowledge areas, and WPACK requires teachers to develop pedagogical strategies to a given subject content within the web and raise an enriched awareness on the ways to reinforce learners while engaging in web-pedagogical practices and making use of web applications by integrating them with the content appropriately (Lee & Tsai, 2010). The development of a scale to assess WPACK levels of teachers, pre-service teachers and teacher educators has given rise to the performance of numerous studies in literature and underscored the significance of skills and knowledge that teachers are required to have in the 21st century classroom.

As another digital age competency having emerged as a result of digitalized learning environments, evaluation, and comprehension of the digital sources in a critical way has gained

importance in the modern education. This notion has provoked the inspection of the new paradigm 'Critical Digital Literacy' (CDL) in terms of its association with effective use of web tools which is considered as one of the fundamental skills of the 21st century (Partnership for 21st Century Skills, 2010).

Gaining importance in the modern education, WPACK has emerged as a nascent paradigm in educational technology and teacher education, and as a recent field of study, most of which were conducted with pre-service teachers (Alsofyani et al., 2012; Chai et al., 2011, 2014; Joo et al., 2018; Kay, 2006; Maeng et al., 2013) originated mostly from the TPACK frameworks of Mishra and Koehler (2006), and Angeli and Valanides (2009). However, on the local vein, there were few studies conducted in the Turkish context with pre-service teachers on the TPACK framework (e.g., Horzum & Güngören, 2012; Kul et al., 2019; Pamuk, 2012; Yurdakul, 2018).

Interestingly, the studies on WPACK with pre-service teachers were more abundant than on the TPACK framework in the Turkish context whereas it was scarcer in other studies conducted in different countries. Most of the studies on WPACK originated from the Asian context where the development of the scales and frameworks originated. Except from the studies on WPACK with pre-service teachers (Akayuure et al., 2013; Chai et al., 2014), there was a scarcity of research performed with pre-service EFL teachers worldwide. The studies performed on WPACK with pre-service teachers in the Turkish context, on the other hand, focused mainly on the self-efficacy levels of pre-service teachers in relation to their WPACK levels (e.g., Aydın et al., 2017; Bağcı & Atar, 2019; Başaran & Yalman, 2020; Hiğde et al., 2014; Kavanoz et al., 2015; Oskay & Odabaşı, 2016; Turan, 2016), on other variables (i.e,. academic achievement, individual innovatiness, internet usafe frequency and/or motivation, online information searching strategies, etc.) that might correlate with it (e.g., Arabacıoğlu & Dursun, 2015; Gökçearslan et al., 2016; Tuluk & Kepçeoğlu, 2019), albeit not specifically related to the pre-service EFL teachers.

Critical Digital Literacy

As the orientation in educational contexts has verged towards the use of digital sources, the favorable utilization of these sources has become much more noteworthy. As a result, the term of 'being literate' has taken on new meanings which has become associated with the concept of 'being digitally literate' in the 21st century. Yet, the origins of digital literacy dates back to the 1980s when the first term 'computer literacy' and its variations such as 'Information Technologies (IT) literacy', 'ICT literacy', and 'technology literacy' were introduced, all of which were related to the acquaintance and experience with computers.

Concomitantly, the term 'information literacy' emanated from this perspective in 1990s stressing the significance of the discovery, recognition, and the assessment of information (Bawden & Robinson, 2002). However, the term 'media literacy' was also associated with this concept which was regarded as a part of IT, and it dealt with the evaluation of mass media while choosing for the appropriate information by using digital tools.

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The idea of digital competence was put forward by Gilster (1997) who described digital competence as:

> *"The concept of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning, and to understand. It is the fundamental act of cognition. Digital literacy likewise extends the boundaries of definition. It is cognition of what you see on the computer screen when you use the networked medium. It places demands upon you that were always present, though less visible, in the analog media of newspaper and TV. At the same time, it conjures up a new set of challenges that require you to approach networked computers without preconceptions. Not only must you acquire the skill of finding things, but you must also acquire the ability to use these things in your life." (p. 1-2).*

Gilster (1997) additionally construed critical thinking as the core skill of digital literacy rather than a mechanical skill, and highlighted the significance of critical evaluation of the information found on web with respect to proper usage of it in our lives. Consequently, it was a crystal-clear fact that developing critical thinking skills together with digital literacy competence in pre- and in-service teachers was paramount in educational contexts of the 21st century, as it would be unreasonable to expect from digital natives, or next generations to lead an isolated life from technology, or to receive education without digital sources, the Internet, and technology.

The importance given to this concept kept increasing in the 21st century. In 2006, the UNESCO's report pointed that digital competence was one of eight core components for lifelong development of an individual, and the European Union (EU) framework asserted that digital competence was as one of eight key competencies for all citizens (European Commission, 2006). The scope of digital literacy was considered as much broader than ICT literacy as it encompassed the aspects of information literacy, media literacy, computer literacy. Yet, its main background had its roots in ICT literacy- the fundamental skills to handle digital software or hardware; however, it would be wrong to assume that an individual with ICT skills was digitally literate, as well (Martin, 2005). A digitally literate person was suggested to have the knowledge of how to use technology to search for information, select and evaluate it, and make use of that information by exchanging with peers, and procreate on it by using distinct web tools. The matter of being digitally literate was linked with having critical thinking skills because the concept was related with critical thinking about the use of technologies, albeit not with its technical elements (Silva & Behar, 2019). Digital literacy was also described by Thorne (2013) as a "semiotic activity mediated by electronic media" (p. 192). This definition emphasizes the meaning making and the analysis of the information processing available in digital sources mentally and visually, pointing out the significance of critical thinking skills.

Furthermore, Lankshear and Knobel (2008) claimed that digital literacy was a mixture of multiple distinct social practices for interpreting the mediated texts including blogs, text messages, video games, memes, discussion forms, and the like through digital codification. Besides, meaning making from the information presented via digital sources did not only

comprise to being digitally literate as "being critical" with those sources was also of vital importance. The reason why being critical, or critical thinking played a significant role in digital learning was that there were several open networks such as Internet in which it was allowed to anyone to publish anything which decreased the reliability of these sources and increased the risk of being misled by that digital source. This aspect of Internet, or other open networks was one of the limitations presented by technological advancements on the grounds that the information presented available to everyone had a probability of being produced by people with a particular religious, political, or ideological viewpoint (Leu et al., 2017). To this respect, being critical with the digital information was regarded as a competence that should be acquired by the digital natives of our era.

Beyond question, encouraging learners to be digitally literate, and to obtain that competence may include some specific strategies that can be incorporated by educators. Media education should be regarded as a fundamental precondition for education since educators are willing to implement the usage of digital media, or Internet into their teaching. Thus, it cannot be assumed that these digital sources are the only means of transmitting information, and they are to be analysed and absorbed critically by learners themselves. They should be practiced actively in a functional way (Buckingham, 2016).

Beyond question, CDL is a newborn phenomenon originated from critical literacy and critical media literacy that underlines the readiness of individuals to live in a digital age (Castellví et al., 2020). CDL has its roots in several disciplines involving computer literacy, ICT literacy, media literacy, information literacy, and e-literacy (Lohnes Watulak, 2016). Since digital media stimulates critical thinking, analysing, using meta-knowledge to evaluate sources, and interact with others, these concepts fall into the CDL's subcategories (Darvin, 2017). It also "... expands the notion of literacy to include different forms of mass communication and popular culture as well as deepens the potential of education to critically analyse relationships between media and audiences, information and power" (Kellner & Share, 2007, p. 4).

The integration of digital literacy and critical thinking skills in education, especially in teacher education, has become quite significant since teachers are regarded as the cornerstones of learners' development of critical thinking and problem-solving skills in the digital age. Thus, it is underscored that CDL requires teachers to be adequately qualified to be able to comprehend digital cultures as they are considered as guiders of learners who assist them to make connections of the digital divides by accessing to information and divergent networks (Poore, 2011). The CDL of the teachers is claimed to be an urgent need (McDougall et al., 2018; Meehan et al., 2015; Santisteban et al., 2020) because it can enable them to create educational mediations and promote curricular materials accordingly. Hence, the key to attain critical citizenry in the digital age is indicated to be established in education and appropriate teacher training at tertiary level (Castellví et al. 2020).

The framework proposed by Hinrichsen and Coombs (2013) has named "the five resources of CDL: a framework for curriculum integration" was quite influential in literature on the grounds

that it has provided a framework for teachers, teacher educators, and policy makers for the integration of CDL in this domain. They have offered a framework for the integration of CDL in the curriculum developed from the CDL model of Freebody and Luke (1990). The main point of the framework is that it does not offer rigid categorization of the following resources, underlining that the resources are related to each other and there is an interrelation between them. The researchers have also pointed that their primary goal is not to change the previously proposed resources completely, but to expand their interpretation by stressing the fluidity of these resources. They, then, have reinterpreted the four resources framed as CDL- 'decoding', 'meaning making', 'using' and 'analysing', and amplify the model further with a fifth resource- 'persona'.

They have defined 'decoding' as "... the familiarity with the structures and conventions of digital media, sensitivity to the different modes at work within digital artefacts and confident use of the operational frameworks within which they exist" (p. 8), and have suggested five characteristic dimensions of decoding: 'navigation', 'conventions', 'operations', 'stylistics', and 'modalities.' In the framework, 'meaning making' is described as an unintentional process where the content, style and the purpose of the text is associated with the reader's previous experience, knowledge and response, and the characteristics of meaning making process are highlighted as 'reading', 'relating', and 'expressing'. The third resource of the framework, namely 'using' refer to the ability to the appropriate and efficient use of digital sources for the tasks in hand, and the characteristic dimensions of it are listed as 'finding', 'applying', 'problem solving', and 'creating'. The fourth source 'analysing' is explained as the ability to reach at knowledgeable reasoning and to make choices in a digital domain and include three characteristic dimensions- 'deconstructing', 'selecting', and 'interrogating'. Lastly, the final resources elaborated in the model 'persona' is described as "sensitivity to the issues of reputation, identity and membership within different digital contexts together with the purposeful management and calibration of one's online persona in order to develop a sense of belonging together with a confident participant role" (p. 12) which is constituted by three characteristic dimensions- 'identity building', 'managing reputation', and 'participating'.

However, empirical studies on the CDL with pre-service teachers in the EFL context did not receive much attention, such that, only few studies treated the concept in detail from different perspectives in literature (e.g., Liza & Andriyanti, 2019; Røkenes & Krumsvik, 2016). What's more, until recently, no previous research has been found to investigate these domains of the pre-service EFL teachers specifically in the Turkish context. However, there were a couple of studies conducted on digital literacy and critical literacy practices with pre-service teachers in the Turkish context (e.g., Ata & Yıldırım, 2019; Çam & Kiyici, 2017), albeit not solely on pre-service EFL teachers in the given context. In this vein, it is expected that this study can contribute to the field by highlighting the interplay between WPACK and CDL levels of pre-service EFL teachers to provide a fresh insight into educators, teacher educators, education authorities, and even pre-service teacher themselves to develop strategies and methods thereof.

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Method

Research Design

This research has a quantitatively driven design in which the quantitative data are situated at the core in order to postulate the findings by means of an in-depth analysis from a wider perspective (Johnson, 2001). Herein, quantitative data are utilized to reveal the Turkish pre-service EFL teachers' levels of WPACK and CDL together with their relationships with one another.

Research Sample

The research was conducted at the department of English Language Teaching at a state university in Türkiye during 2020-2021 academic year. All the students in the department were invited to participate in the study; however, participation in the research was based on the principle of voluntariness.

Beyond question, sampling methods were demanded for maximizing efficiency and validity of the research. Thus, convenience sampling method was utilized which was a quite common sampling method in second language studies (Mackey & Gass, 2005) that provided researcher with a sampling group who were easy to access and met the criterion for the sample as a type of purposeful sampling designs.

Demographic information obtained from the participants regarding their age, gender, level of education, family income level, personal computer ownership, and frequency of web tools usage (i.e., always, sometimes, rarely, very rarely, never). The sample size of the study consisted of 94 participants in total studying at the department of English Language Teaching at a state university in Türkiye. Demographic information is presented below:

Table 1. *Demographics of the Participants*

		n
Gender	Male	36
	Female	56
	Prefer not to say	2
Age (Group)	17-21	77
	22-26	12
	27+	5
Level of Education	Freshmen	44
	Sophomore	26
	Junior	20
	Senior	4
Frequency of Web Tools Use	Always	73
	Sometimes	20
	Very rarely	1
Personal Computer Ownership	Yes	85
	No	9

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As illustrated in Table 1, of 94 participants in total 56 were female (59.6%), 26 were male (38.3%), and 2 were reported as 'prefer not to say' (2.1%). The age distribution of the participants was ranged as 17-21 (n= 77), 22-26 (n= 12), and 27 and above (n= 5). The participants consisted of 44 freshmen (46.8%), 26 sophomores (27.7%), 20 juniors (21.3%), and 4 seniors (4.3%). It was also observed that 85 of them (P= 90.4%) owned a personal computer whereas 9 of them (P= 9.6%) did not. Lastly, of 94 participants, the frequency of web tools usage was reported as always (n= 73, P= 77.7%); sometimes (n= 20, P= 20.3%), and very rarely (n= 1, P= 1.1%).

Herein, it is worth noting that all senior students in the department have taken the courses of BIL101 Information Technologies, EBB605 Instructional Technologies, and IDE201 Approaches to English Language Learning and Teaching, all of which are likely to have an indirect impact on the participants' responses to the questionnaires. To note more, junior students have taken BIL101 Information Technologies and EBB605 Instructional Technologies courses, and the sophomores have only taken BIL101 Information Technologies course.

Research Instrument and Procedures

For data collection, an online survey, which was consisted of third sections, was employed in the form of Google Forms. The first section required demographic information of the participants, which were age, gender, level of education, family income level, personal computer ownership, and frequency of web tools usage. The second section of the survey included the 5-point Likert type items, ranked from Strongly Disagree (1) to Strongly Agree (5), named as 'Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey' proposed by Lee and Tsai (2010). The third section comprised of 5-point Likert type items again, ranked from Strongly Disagree (1) to Strongly Agree (5), adapted from the 'Critical Digital Literacy Framework' of Henrichsen and Koombs (2013).

To elaborate, the factors in the first instrument were noted as (1) web-general, (2) web-communicative, (3) web- content knowledge, (4) web-pedagogical-content knowledge, and (5) attitude toward web-based instruction. Besides, the constructs in the second instrument were (1) decoding, (2) meaning making, (3) using, (4) analysing, and (5) persona, each of which included their own sub-dimensions. To elaborate, the sub-dimensions of decoding construct were navigation, conventions, operations, and modalities. The sub-dimensions of meaning making construct were reading, relating, and expressing. The sub-dimensions of using construct were finding, applying, problem solving, and creating. The sub-dimensions of analysing were deconstructing, selecting, and interrogating. Lastly, the sub-dimensions of persona were identity building, managing reputation, and participating.

Due to the restrictions of the worldwide pandemic situation, the quantitative data were not collected face-to-face at one sitting, yet collected through an online survey created on Google through Google Forms. The online survey was shared with the participants through the agency of their instructors on Microsoft Teams, which was employed as a learning management system during the pandemic at the proposed university. The researchers attended the first 15 minutes of each online course for each level, and were briefly explained the research topic. The data

collection tools within the survey were introduced to the participants and responded to any possible questions of the participants regarding them. The consents of the participants were obtained before filling. After the introduction part, the participants were given probable time to fill in them under the provision of their course instructor(s) on voluntary basis. The online survey was shared in the course groups on Microsoft Teams for absent students, and they filled it after the course when they were available, as well. The overall data collection process was lasted for two weeks.

Validity and Reliability

The first instrument employed for data collection was the 'Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey' developed by Lee and Tsai (2010) with five factors composed by 30 items. Reliability analysis was employed with an attempt to measure internal consistency of the instrument, from which the Cronbach Alpha coefficient was stipulated to be above .70 in order to be deemed as internally consistent in the field of Social Sciences (Mujis, 2004). The Cronbach Alpha coefficient of the instrument was calculated as .949. Additionally, split-half reliability analysis was also conducted to reaffirm the internal consistency through the results created from the two subsets of items by halves (n1= 15; n2= 15) and reported as .935 (r1) and .927 (r2).

The second instrument utilized for data collection was adapted from the 'Critical Digital Literacy Framework' of Henrichsen and Koombs (2013) and transformed into a 5-point Likert type format. The questionnaire involved five constructs with 45 items. Reliability analysis was employed with an attempt to measure internal consistency of the instrument, from which the Cronbach Alpha coefficient was stipulated to be above .70 in order to be deemed as internally consistent in the field of Social Sciences (Mujis, 2004). The Cronbach Alpha coefficient of the instrument was calculated as .970. Additionally, split-half reliability analysis was also conducted to reaffirm the internal consistency through the results created from the two subsets of items by halves (n1= 23; n2= 22) and reported as .962 (r1) and .927 (r2).

Data Analysis and Process

The quantitative data were analysed by the Statistical Package for Social Sciences (SPSS, Version 27.0). Detecting items throughout data entry, frequency analysis yielded no abnormality. There were neither reverse coded nor controlling items in the instruments. The emergent data showed that neither of the items did have a big impact on the reliability statistics; and thus, none of them was omitted. The assumption of normality for the sample scale (n= 94) was analysed via examination of the items for both the instruments. The test of normality was conducted in order to check if data were normally distributed or not. According to the results gained by the Kolmogorov-Smirnov test of normality, the factor list was spotted to be insignificant for each of the variables (i.e., gender, age, owning a personal computer) respectively with the p level above .05; thus, appropriate to run parametric tests. As the Kolmogorov-Smirnov test of normality confirmed normality, no other test (i.e., Test of Homogeneity) was conducted.

In order to stipulate normal univariate distribution, the values for skewness should be between -2 and +2 whereas the values for kurtosis should be between -7 and +7 (Bryne, 2010). Correlatively, the values for skewness (= -1.368) and kurtosis (= 3.452) were considered

acceptable, which also proved normality as an assumption. However, it was to be noted that there were some outliers revealed by the histogram chart with a slightly leptokurtic distribution in which the tails were little bit fatter since kurtosis was greater than +3. Yet, normality was enabled albeit for some outliers as the Q-Q Plots and histogram chart together with the appropriate sample size (N= 94) indicated so. Additionally, the range (= 63.00) was divided by six to see the expected standard deviation (= 10.50). The calculated standard deviation of the test was accepted as proportionate (SD= 10.31). The scores of means (= 61.00), mode (= 62.00) and median (= 62.00) were either so close or equal confirming the normality of the distribution as another assumption. In the light of these, it was stipulated that the data were normally distributed which favoured the use of parametric tests in order to see the group differences.

To note, the results of the reliability tests in relation to the utilized instruments confirmed that the instruments were highly reliable (r above .80). Besides, descriptive statistics were used to mark demographic information of the participants. Independent samples t-tests and ANOVA were performed to analyse if specific differences blossomed across the participants in lieu of independent variables. To add with, bivariate correlations were used to explore the relationships among the frameworks mentioned so far.

Findings

To reveal the WPACK levels of the participants, frequency analysis of the 'Technological Pedagogical Content Knowledge-Web (TPCK-W) Survey' developed by Lee and Tsai (2010) was reported. The results indicated that the WPACK levels of the Turkish pre-service EFL teachers were high (M = 4.24, SD = .50). Additionally, the descriptive statistics was conducted, and mean scores for each construct were presented below in tow:

Table 2. *Frequency Analysis on the Participants' WPACK Levels*

	n	Min	Max	M	SD
WPACK (total)	94	2.03	5.00	4.2406	.50975
Web General	94	1.57	5.00	4.4472	.57308
Web Communicative	94	2.25	5.00	4.3590	.57567
Web Content Knowledge	94	2.00	5.00	4.4340	.54920

Web Pedagogical Content Knowledge	94	1.75	5.00	3.9295	.78835
Attitude towards Web-based Instruction	94	2.50	5.00	4.1897	.65701
Valid n (listwise)	94				

The results from Table 2 demonstrated that the construct with the highest mean score was Web General (M = 4.44, SD = .57) and the lowest was Web Pedagogical Content Knowledge (M = 3.92, SD = .78). Accordingly, it could be presumed that participants had relatively lower score of web pedagogical content knowledge compared to the other constructs; however, they had a high mean score of web general knowledge. This result implied that having a high level of web general knowledge might not necessarily lead to the acquisition of a high level of web pedagogical content knowledge, which might be since WPACK was a knowledge type consisted of different segments and the interaction between these knowledge areas.

Lastly, the component based descriptive statistics of TPCK-W was operated to reveal the three highest and lowest mean scores of each component. The statement with the highest mean score was the eighth statement "I am able to read others' messages in a chatroom." (M = 4.73, SD = .53) and the lowest was the eleventh statement "I am able to provide information or respond to someone else on a BBS (Bulletin Board System)." (M = 3.51, SD = 1.10), implying that the Turkish pre-service EFL teachers marked themselves as capable of reading others' messages in a chat room, however; they did not mark the same regarding the providing information or responding to someone else on a BBS.

The statements with the highest and lowest mean scores were both related to Web Communicative construct in the survey which contradicted with the previous mean score analysis of the survey's constructs, pointing the constructs with the highest and lowest mean scores as Web General and WPACK. This might be caused by the total numbers of statements residing to each construct differed, in that there were 4 items of Web Communicative whereas 7 for Web General, and 8 for WPACK.

Besides, in order to uncover the CDL levels of the participants, frequency analysis was operated. The results demonstrated that the CDL levels of the Turkish pre-service EFL teachers were moderately high (M = 3.95, SD = .53). Additionally, the descriptive component analysis of CDL was conducted and each construct's mean scores were presented, as well.

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Table 3. *Frequency Analysis on the Participants' CDL Levels*

	n	Min	Max	M	SD
Decoding	94	1.82	5.00	4.1596	.65293
Meaning making	94	2.00	5.00	3.9590	.67288
Using	94	2.00	5.00	3.9858	.62584
Analysing	94	2.22	4.78	3.6726	.54442
Persona	94	2.00	5.00	3.9663	.55873
Valid n (listwise)	94				

The results from Table 3 demonstrated that the construct with the highest mean score was Decoding (M = 4.15, SD = .65) and the lowest was Analysing (M = 3.67, SD = .54). Accordingly, it could be stipulated that participants perceived themselves as highly capable of comprehending the practical and operational aspects of CDL; on the other hand, they did not perceive their capability of making critical and ethical judgements on digital materials as high as decoding.

In addition to this, the sub-construct mean score analysis of each main construct with the highest (i.e., modalities) and lowest (i.e., conventions) mean scores of them were also reported. The results from indicated that the sub-construct of the Decoding construct with the highest mean score was Modalities (M = 4.25, SD = .64) and the lowest was Conventions (M = 4.04, SD = .76) among four sub-constructs. This result implied that participants marked that they were able to decode the information and present it to the others competently whereas their ability to envision the practices and norms of ICT usage in terms of norms and practices were relatively lower. The results also demonstrated that the sub-construct of the Analysing construct with the highest mean score was Deconstructing (M = 3.87, SD = .73) and the lowest was Selecting (M = 3.61, SD = .56). This result also indicated that the sub-constructs' mean scores of Analysing was relatively lower compared to Decoding, entailing that participants' level of analysing the digital information and drawing conclusions on it was comparably lower than their comprehension level of ICT usage and its norms. Moreover, the results suggested that participants' capability of

distinguishing meaningful aspects of digital transmission was relatively higher than their level of making inferences about digital tools and products.

Lastly, the component based descriptive statistics for CDL was conducted in order to reveal the three highest and lowest mean scores of each component. The data hinted that the highest mean score for the components of CDL was the tenth statement "I am aware that different modes of digital texts (e.g., video, immersive game, SMS, twitter streams) have different characteristics and conventions." (M = 4.38, SD = .67), and the lowest was thirtieth statement "I can reject digital systems, content, networks, or artefacts." (M = 2.47, SD = 1.09), verifying the previous results on descriptive construct and sub-construct analysis. This result indicated that participants' levels of discarding certain digital system by differentiating about appropriateness were quite low whereas their levels of apprehensiveness of digital texts' different conventions were relatively high.

Moreover, with an attempt to uncover whether there was a statistically significant difference in WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of age, a one-way analysis of variance (ANOVA) test was performed. The one-way analysis of variance (ANOVA) test results demonstrated that there was no statistically significant difference at the $p<.05$ level in WPACK [$F (89, 91) = .122$, $p = .885$], and CDL [$F (2, 91) = 1.082$, $p = .343$] levels of the Turkish pre-service EFL teachers in terms of age. This result could be attributed to the distribution of sample group's age as 81.9% percent was between 17-21 years old and only 5.3% was 27 years above.

Besides, to reveal whether there was a statistically significant difference in WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of gender, an independent-samples T-test was conducted to compare the gender groups. According to the independent-samples T-test results given above, no significant differences at the $p<.05$ level were found in WPACK levels of females (M= 4.20, SD= .45) and males (M= 4.27, SD= .10); $t(88) = -.663$, $p= .509$, and CDL levels of females (M= 3.96, SD= .46) and males (M= 3.94, SD= .63); $t(90) = -.180$, $p= .857$. Besides, the magnitude of the differences in the means was not calculated with eta squared ($\eta 2$) since the results were insignificant.

One more to note, in order to reveal whether there was a statistically significant difference in WPACK and CDL levels of the Turkish pre-service EFL teachers in terms of personal computer ownership, an independent-samples T-test was employed. According to the independent-samples T-test results, no significant differences at the $p<.05$ level were found in WPACK levels in terms of owning a personal computer (M= 4.22, SD= .52) and not owning (M= 4.35, SD= .37); $t(90)= .710$, $p= .479$, and CDL levels in terms of owning a personal computer (M= 3.96, SD= .54) and not owning (M= 3.91, SD= .54); $t(92)= .263$, $p= 793$. This could be resulting from the fact that 90.4% of the participants stated that they owned a personal computer. Besides, the magnitude of the differences in the means was not calculated with eta squared ($\eta 2$) since the results were insignificant.

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Finally, to reveal whether there was a relationship amidst the Turkish pre-service EFL teachers' levels of WPACK and CDL, a Pearson product-moment correlation analysis was computed. The bivariate correlation between WPACK and CDL of the Turkish pre-service EFL teachers was signed as positively high by $r(94)= .73$, $p< .01$. Herein, the coefficient of determination ($r2$) was also estimated in order to explain the measures (i.e., percentage levels) in terms of how well this statistical model could predict the expected outcome. A coefficient of determination of 53% between WPACK and CDL showed that 47% of the data fit the regression model. Since a higher coefficient indicated a better fit for the model, it could be stipulated that the coefficients of determination for WPACK and CDL levels of the participants were relatively high.

Confronting the idea that technology acceptance model (TAM) was the keystone for technology acceptance, use and maintenance and the highest correlation was estimated between WPACK and CDL, a partial correlational analysis between WPACK and CDL was computed to reveal whether this highest positive correlation between WPACK and CDL was still existing when TAM was controlled. According to the results, the correlation between WPACK and CDL of the Turkish pre-service EFL teachers was still intact by positively high scores of $r(89)= .62$ when TAM was controlled, and this relationship was still significant at the level of $p< .01$ ($r2= .38$). The correlational analysis results demonstrated that there was a high positive linear relationship among given variables of the Turkish pre-service EFL teachers, implying that an increase in the technology acceptance levels of the participants could lead to an increase in their WPACK and CDL levels as well as in decrease. Furthermore, it could be deduced from the results that the relationship between WPACK and CDL of the Turkish pre-service EFL teachers was not decreased by their technology acceptance levels, signifying that technology acceptance alone might not be the main determinant of the correlational relationship between the participants' levels of WPACK and CDL.

Discussion, Conclusion, and Recommendations

The WPACK levels of the participants are calculated, and the average score of the WPACK levels is found as 4.24 with the standard deviation of .51 out of 5.00, which is high. The highest and lowest mean scores of its sub-levels are Web General with 4.45 and Web Pedagogical Content Knowledge with 3.93. This finding indicates that the pre-service EFL teachers possess high level of web general knowledge and low general knowledge of web pedagogical content. When component-based analysis is conducted on WPACK elements, the survey items 'I am able to read others' messages in a chatroom' ($M= 4.73$) and 'I am able to download pictures from the Web' ($M= 4.69$) get the highest mean scores. On the other hand, the survey items 'I am able to provide information or respond to someone else on a BBS (Bulletin Board System)' ($M= 3.51$) and 'I know how to apply teaching modules on the Web into courses' ($M= 3.76$), have received the lowest average scores from the pre-service EFL teachers. The findings that are related to the web pedagogical content knowledge of pre-service EFL teachers are also aligned with the previous research findings (e.g., Gökçearslan et al., 2017; Kavanoz et al., 2015; Lee & Tsai, 2010) as possessing higher levels of web pedagogical content knowledge by teachers and teacher candidates.

Another major key finding of the present research asserts that the WPACK levels of the Turkish pre-service EFL teachers are high, consistent with the previous studies in literature by the studies of Hiğde et al. (2014), Oskay and Odabaşı (2016), and Bağcı and Atar (2019). Following, the technology acceptance levels are detected to be moderately high in line with the research findings of Baturay et al. (2017) as with their CDL levels being moderately high as well, in accord with the results of Çam and Kiyici (2017). Yet, this finding is on the contrary to the research findings of Ata and Yıldırım (2019) which can be attributed to the differences in sampling groups in terms of number and participants' departments.

Next, another result of the study is related to the CDL levels of the pre-service EFL teachers. It is reported that they have scored an average of 3.96 out of 5.00, considered as medium-high level of critical digital knowledge. Specifically, they have showed high level knowledge regarding decoding and using their CDL. The lowest average scores are received from analysing and persona. Considering teachers' levels of higher knowledge being at low levels and difficulty in achieving higher cognitive skills, such a finding is not surprising. Previous studies (e.g., Silvhiany et al., 2021) have also showed similar results as they indicate that despite born as a Z generation in the global and digital world, and adapted to using social media and online resources in their everyday practices, learners cannot critique various platforms, such as online sources. The sub-levels of CDL for the Turkish pre-service EFL teachers showed that navigation and modalities are highly developed for them. They get the lowest mean scores for the areas of deconstructing, creating and selecting. Such findings have also revealed that teachers lack higher levels of cognitive skills. These results are aligned with the previous research findings (e.g., Silvhiany et al., 2021).

The findings of ANOVA test have indicated that there exists no significant difference in terms of age groups regarding WPACK and CDL levels. Specifically, this finding has indicated that levels of WPACK and CDL do not go up as age levels increase. These results can barely justify that age intervals are not high enough, and the number of the participants in each age group are not homogenous which may not get results with significance. Such a result is surprising considering previous research findings (Kavanoz et al., 2015; Yesiltas, 2016) as they have asserted that age is a critical independent variable that affects WPACK of the teachers. Besides, Venkatesh et al. (2003) have found out indirectly that age is one of the demographics that promotes using behaviour via behavioural intention, facilitating conditions, social influence, effort expectancy, and performance expectancy. Age, in addition to experience, is considered as a very important factor and demographic feature that positively affects the levels of technology acceptance, WPACK and CDL (Wang & Chen 2009) since young generations easily manage to create a higher understanding and acceptance of digital tools and technologies compared to the older counterparts.

Another research question is related to gender to check whether the Turkish pre-service EFL teachers are differing with their levels of WPACK and CDL. The findings showed that there was no statistically significant difference in terms of gender within the scope of technology acceptance, WPACK and CDL levels of the Turkish pre-service EFL teachers. This result can be

resulted by the fact there were more female teachers than male teachers. In the same vein, the result is not supported with some previous studies as they (Chung, 2010; Morris & Venkatesh, 2000; Nazzal et al., 2021; Trocchia & Janda, 2000; Wang & Chen 2009) have found that gender does not play a role in any way to improve digital literacy. On the other hand, compared to other previous research findings (Venkatesh et al., 2003), such a result is surprising as they (Venkatesh et al., 2003) have also found out that gender is indirectly accepted as one of the demographics that promote using behaviour via behavioural intention, social influence, effort expectancy, and performance expectancy. In order to better understand how gender affects decision-making and buying behaviour, several research on the acceptability of new IT systems have been conducted. These studies have found that different gender types evaluate different IT characteristics and uses (Kavanoz et al., 2015; Morris & Venkatesh, 2000).

Following this, the Turkish pre-service EFL teachers' personal computer ownerships is evaluated whether there is statistically significant in lieu of their web pedagogical content knowledge and CDL levels. The findings have showed that no significant differences exist between having a personal computer and their technology acceptance, web pedagogical content knowledge, and critical digital literacy levels. However, it should be noted that the percentage of participants with personal computer (P= 95%) was much more than those with no personal computer. Since compared to some of the findings in the previous studies, it is found that experiencing and using personal computers affects technology acceptance intentions in two different ways, levels or areas including mediated and/or direct effects. Specifically, being proficient in a technology is expected by the gathered benefits of the acceptance of a computer and/or other technologies; henceforth, there is a direct correlation between owning technology and technology acceptance. This topic should be investigated in more detailed way to identify the relationships between owning, using, and being proficient on technology together with the levels of technology acceptance. Lastly, it is found that there exists a statistically significant relationship between critical digital literacy and web pedagogical content knowledge. Specifically, the relationships between these variables are positively high. Such findings are also aligned with the studies conducted in literature (Akar & Guzin, 2019; Korucu, 2011). Akar and Guzin (2019) have concluded that WPACK could be explained by both technology acceptance and CDL.

Limitations

Pedagogical content knowledge is initially proposed as a third important component of teaching competence, in addition to instructors' subject matter (content) knowledge and their general understanding of instructional procedures (pedagogical knowledge). Considering fast developments in the pedagogical content and related application tools used in the language classrooms, such suggestions are considered as promising. Such suggestions are also supported by previous research findings (Kavanoz et al., 2015) as they have suggested web-based instructions as a method to improve teachers' WPACK. They have noted that especially language teachers as pre-service or in-service can benefit from web-based professional development and instructional approaches in their professions, or at teacher preparation programs. They have also confirmed that additional qualitative methods, including observation

or interviews, may help paint a fuller picture of how pre-service EFL teachers feel about using Internet, and other web-based tools for instruction.

Secondly, it is suggested that teachers should conduct research and practice on the field (i.e., action research) because it is not enough just to learn how to do them. Instead of that, they are expected to learn practicing on the levels of implementation. Finally, effective courses should be utilized for teachers to learn more about CDL. Considering teachers' needs and necessities of being digitally literate, learning practical concepts in professional development courses and practicing them in their future language classrooms are considered as promising. Accordingly, learning on-the-job (e.g., video production) can improve elementary teachers' critical literacy levels and understandings. Also, they have showed that video production courses or instructional technologies can be included in online courses and other professional development workshops and seminars as well as courses in teacher preparation programs. Correlatively, both inductive and deductive analytical methods can be used since pre-service teachers are to be given instruction in relation to information and data literacy, communication and teamwork, creating digital material, safety and problem-solving, as well.

In lieu of methodology, the number of participants should be more than the current study to compare groups and participants with proper statistical tools and estimations. The sample groups could be selected from both pre-service and in-service teachers within the perspective of a comparative analysis in between. As a variable, owning a personal computer should be investigated in more detailed way in order to identify the relationships between owning, using, and being proficient on technology together with the levels of technology acceptance as the literature reported so, which might affect the results in a different way. The participants could be face-to-face interviewed to have a better understanding of their perspectives toward technology and it susage in the language classrooms.

Last but not least, in order to eliminate social desirability as an effect to hinder the reliability and validity of the results, a more robust way of understanding if pre-service EFL teachers' own belongings (knowledge and skills) could be employed, or they might report themselves with the highly desired values that an EFL teacher should have in the future to be having web pedagogical content knowledge embellished with technological and critical literacy. Herein, in-class observations might be executed in order to identify whether they could implement them in real classroom environment.

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