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Raihanah Sukri, Zanaton Hj Iksan

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## Utilizing Information and Communication Technology (ICT) on Communication Skills: A Systematic Review

Raihanah Sukri, Zanaton Hj Iksan

Faculty of Education, Universiti Kebangsaan Malaysia (UKM)

Email: rraisukri@gmail.com, zanaton.iksan@ukm.edu.my

### Abstract

Information and Communication Technology (ICT) plays an important role in the education system that can impact communication skills. Although there are various studies on the impact of ICT on communication skills, but the effort to make a systematic study of related research topics is a challenge because it is found that there is a lack of diversity of studies about the topic that also involves TPACK elements. This study aims to conduct a systematic review on the impact of ICT on communication skills containing a focus analysis of TPACK knowledge. The search for articles is from few search engines to analyze the trend of publishing articles related to the study. The analysis shows two main findings which are trends covering the distribution of data and the impact of ICT on communication skills (and raised as themes of discussion in this systematic review study). There are five themes found: (i) verbal communication; (ii) confidence; (iii) effective communication; (iv) digital literacy; and (v) linguistics. One of the implication is to prove the extent to which ICT use in teaching and learning sessions able to affects communication skills among educators or students.

**Keywords:** ICT, Communication Skills, TPACK, Teaching and Learning, Education, Systematic Review

### Introduction

The current wave of globalisation and digitalization is increasing the realm of communication. In order to enhance students' communication skills, information and communication technology (ICT) must be effectively incorporated into subject matter. Additionally, by emphasising delivery of concepts from the fundamentals to the comprehension of new concepts, educators (such as teachers and lecturers) are able to convey learning concepts to students through communication (Peters & Abdullah, 2017). Peters and Abdullah (2017) also added that in order to prevent misinterpretation, educators' delivery strategies must be used carefully and precisely. Hence, there must be a tool need to be integrated in teaching and learning sessions so that the learning objective matters would be acquired.

Covid-19 pandemic outbreak broke the space of direct communication when learning sessions had to be done remotely. However, by utilizing already-existing technology, a new paradigm in education was developed. This is seen to benefit students who are inclined to

audio and visual learning styles when learning is conducted online and further influences communication between educators and students in obtaining results and the impact on the learning process (Kirin et al., 2021).

Technology is one of the most influential instruments in achieving the changing needs of education (Mercado et al., 2019). Hence, the ability of educators to incorporate technology into learning is crucial in dealing with the challenge of today's technological world, where the development of learning needs to adapt to the progress, for example, through the Technological Pedagogical Content Knowledge approach, or TPACK (Yanti et al., 2019).

To demonstrate their proficiency in the teaching and learning process, educators in the twenty-first century must be able to use the TPACK framework (Malik et al., 2019). This is a result of the quick growth of technology, which forces instructors to comprehend this framework and use it in their lessons, particularly when teaching and learning subject topics (Yanti et al., 2020). The seven structures or key knowledge components that make up the TPACK framework or model, as shown in Figure 1, are as follows: i) content knowledge; ii) pedagogical knowledge; iii) technological knowledge; iv) pedagogical content knowledge; v) technological pedagogical knowledge; vi) technological content knowledge; and vii) technological pedagogical content knowledge.



Figure 2. TPACK Framework (Koehler & Mishra, 2009)

It is crucial to do research on communication skills using the TPACK framework because, in the modern world, technology and communication are crucial components of developing 21st-century skills and overcoming the problems of the fourth industrial revolution (IR 4.0). The ability to deliver knowledge or learning content using a pedagogical approach and technology is demonstrated by educators who incorporate the TPACK approach during teaching and learning sessions. This helps to increase students' understanding of what they are learning.

Therefore, to explore the impact of ICT on communication skills, this systematic study includes two research questions, namely i) what is the research trend related to the impact of ICT on communication skills demographically (period, country, sample, subject (discipline field), research design and knowledge focus of TPACK elements? and ii) what is the impact of ICT on communication skills? In this systematic review, it also covers numerous structures such as methodology that describes in depth about the procedure carried out, research findings to answer research questions, discussion based on the research theme analysis and conclusion to conclude this systematic review.

### Methodology

Through the use of a grounded methodology, this systematic study was conducted to give an overview of the gap and direction of future studies (Sabudin & Halim, 2020). Aim of this study is to provide a thorough understanding of the impact that Information and Communication Technology (ICT) use, as applied by the TPACK approach, can have on various levels of communication skills in during teaching and learning sessions specifically. This systematic review used The PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria Page et al (2020) as a guideline to create review. Through the PRISMA method guidelines, there are two research questions formed, namely i) what is the research trend related to the impact of ICT on communication skills demographically (period, country, sample, subject (discipline field), research design and knowledge focus of TPACK elements? and ii) what is the impact of ICT on communication skills?

Based on the research questions, "ICT," "Communication Skills," and "TPACK" were determined to be the three main keywords. The researcher searches for synonyms, similar terms, and keyword variations to vary their keyword selection. The keyword strings used by SCOPUS and Web of Science are displayed in Table 1 below. Additionally, the search process was carried out utilizing the manual search method of "handpicking" on the Science Direct and Google Scholar search engines (Shaffril et al., 2021).

Table 1  
*Keyword Strings Used in Search Engines*

Search Engines	Keyword Strings
SCOPUS	TITLE-ABS-KEY(("ict" OR "information and communication technology") AND ("communication skill*" OR "effective communication*" OR "digital literac*" OR "verbal communication*" OR "non-verbal communication*") AND ("TPACK" OR "TPCK" OR "technological pedagogical content knowledge"))
Web of Science	TS(("ict" OR "information and communication technology") AND ("communication skill*" OR "effective communication*" OR "digital literac*" OR "verbal communication*" OR "non-verbal communication*") AND ("TPACK" OR "TPCK" OR "technological pedagogical content knowledge"))

Using the term, a total of 61 articles were located in the search engine. The title and abstract of the article are then subject to screening. The complete text of linked research whose abstracts or titles could not adequately summarize them was examined to ascertain their eligibility. The articles must meet the following criteria in order to be considered for the synthesis: (i) empirical research; (ii) demonstrating a link between the integration of ICT and communication skills; (iii) being written in English; and (iv) being made available in an easily accessible complete text.

Articles that do not address how ICT integration affects communication skills or that do not even mention the knowledge focus of the TPACK elements in the study in their outlines are excluded. The method of searching for and choosing articles based on PRISMA (2020) is depicted in Figure 2.

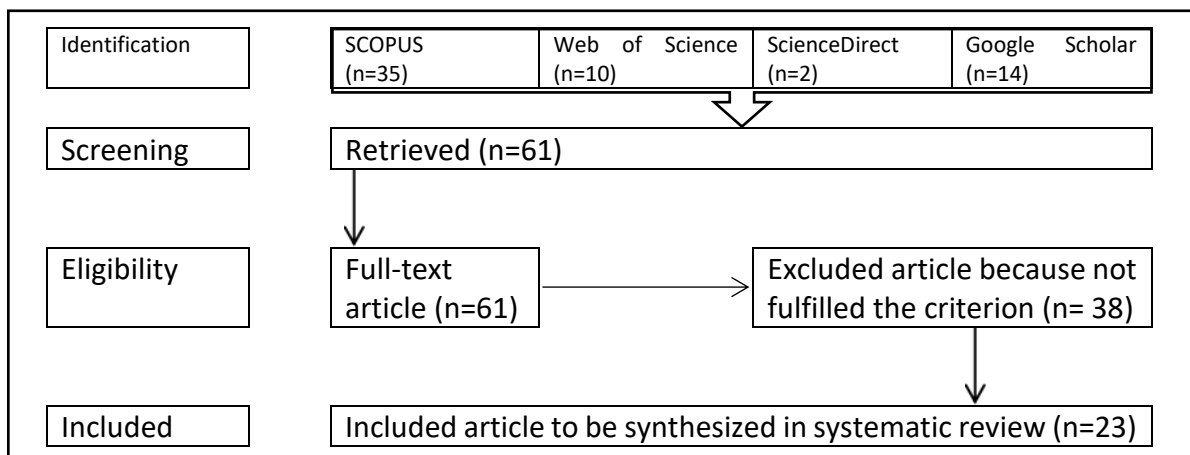


Figure 2. Article Search and Selection Process Based on PRISMA (2020)

### Findings

Based on the analysis of all the articles in this systematic review study, the findings below are to answer the research questions which are i) what is the research trend related to the impact of ICT on communication skills demographically (period, country, sample, subject (discipline field), research design and knowledge focus of TPACK elements? and ii) what is the impact of ICT on communication skills?

### Demographic Analysis to Determine Study Trends

The first question, "What is the research trend related to the impact of ICT on communication skills demographically?" was addressed by looking at the research trends from 2007 to 2022, which are displayed in Table 2.

Table 2

Trend Analysis of ICT Impact Study on Communication Skills Demographically

Period	Authors/Y	Country	Sample		Subject Field							Research Design			Knowledge Foci						
			Educator	Student	S	E	M	STEM	L	Ed	N/A	Quantitative	Qualitative	Mixed Method	C	T	P	TC	PC	TP	TPACK/TPCK
I (2007-2011)	Almås & Krumsvik (2007)	Norway	/									/	/							/	
II (2012-2016)	Alev et al. (2012)	-	/		/								/						/		/
	Heitink et al. (2012)	-	/									/	/		/	/	/	/	/	/	/
	Leendertz et al. (2013)	South Africa	/			/						/									/
	Gill et al. (2015)	Australia	/									/	/				/		/	/	/

	Ndongfack (2015)	Cameroon	/		/	/			/	/	/	/	/	/
	Jaikaran-Doe. & Doe (2015)	Australia	/	/		/					/		/	/
III (2017-2022)	Mutanga et al. (2018)	Zimbabwe	/	/				/						/
	Rodliyah (2018)	Indonesia	/		/		/							/
	Harits et al. (2019)	Indonesia	/	/			/			/	/	/	/	/
	Mercado & Ibarra (2019)	Philippines	/		/		/			/	/	/	/	/

Redmond & Lock (2019)	South Australia	/			/		/		/	/	/	/	/	/
Casta et al. (2020)	Thailand	/		/			/			/				
Purwaningsi et al. (2020)	Indonesia	/	/	/		/								/
Tondeur et al. (2020)	Belgium	/			/	/	/			/				/
Trabelsi et al. (2021)	Tunisia	/				/			/		/	/	/	/
Morales et al. (2021)	Philippines	/		/			/		/	/	/	/	/	/



Voigt (2021)	German	/	/	/	/	/	/	/
Strydom et al. (2021)	South Africa	/	/	/	/	/	/	/
Sapad & Caballes (2022)	Philippine	/	/	/	/	/	/	/
Kayaalp et al. (2022)	-	/	/	/	/	/	/	/
Irdalisa (2022)	Indonesia	/	/	/	/	/	/	/
Tafazoli & Meihami (2022)	Iran	/	/	/	/	/	/	/

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<b>Overall</b>	<b>21</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>13</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>7</b>	<b>12</b>	<b>10</b>	<b>14</b>	<b>19</b>
														<b>3</b>					

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Sample - Educators (such as teacher, lecturer, instructors, etc.) , Student (from early education until tertiary education)

Subject Field - Sn (Science - including biology, chemistry and physics discipline field), En(Engineering), Mt (Mathematics), STEM, Lg (Language), Edu (Education), N/A (not specifically stated).

Knowledge Foci - CK (Content Knowledge), TK (Technological Knowledge), PK (Pedagogical Knowledge), TCK (Technological Content Knowledge), PCK (Pedagogical Content Knowledge), TPK (Technological Pedagogical Knowledge), TPACK/TPCK (Technological Pedagogical Content Knowledge)

Table 2 displays the study trend demographically, including the time frame (period), country (the study location), sample, subject field (the study's focus), research design, and methodology. Analysis of 23 papers revealed that the TPACK-based study on the effects of ICT integration on communication skills began in 2007. As a result, the study from 2007 to 2022 was separated into three periods in order to explore more thoroughly (Huang et al., 2022), namely Period I (2007–2011), Period II (2012–2016) and Period III (2017–2022). According to the analysis's findings, Period I contained only one study, Period II contained six, and Period III contained sixteen. Comparing Period III (2019–2022) to Period I (2009–2013) and Period II (2014–2018), related studies generally seem to be growing. The most studies were conducted in Asia (n=8) consisting of Indonesia, the Philippines, Thailand, and Iran, followed by four Africa (South Africa, Cameroon, Zimbabwe & Tunisia). The following three studies are from Australia and European studies (Norway, Belgium and Germany). The another three being categorized as "-" (n=3) because the study's location was not made clear.

Trend analysis for the study sample shows that most of the sample groups are among educators (n=21) followed by students (n=3). This demonstrates that a lot of studies use educators such as teachers and lecturers as a study sample. The majority of research (n=6) do not directly address the subject domain. The fields of science, with five studies, and education, with four studies, are the ones that come next. Domains for mathematics, STEM, and language each display the results of two research.

The majority of studies that have been done employ a qualitative approach (n=9) as a research design. For quantitative and mixed method research design, both demonstrates the same number of study found which is seven. In 2009, the study began using the TPACK framework as a template for the research being out. This may be the case as Shulman's first established pedagogical content knowledge in 1986 and further expanded it in 1987, whereas Mishra and Matthew Koehler first published the TPACK framework in 2006 (Huang et al. 2022). Therefore, it is not surprising to learn that the researcher explicitly stated in 2007 that PCK became the focus of his study. Most studies employ the TPACK knowledge emphasis (n=19), followed by TPK (n=14), TK (n=13), TCK (n=12), PCK (n=10), PK (n=7), and CK (n=6), based on the seven structures in the TPACK framework. Based on Period I, PCK was the most frequently utilized knowledge focus, however for Periods II and III, TPACK was employed as a knowledge focus in five studies for Period II and thirteen studies for Period III, as opposed to the other six structures.

### **Impact of ICT on Communication Skills Analysis**

A thorough analysis of the chosen studies was conducted in order to respond to the second study question, "What is the impact of ICT on communication skills?" The analysis's findings are depicted in Figure 3.

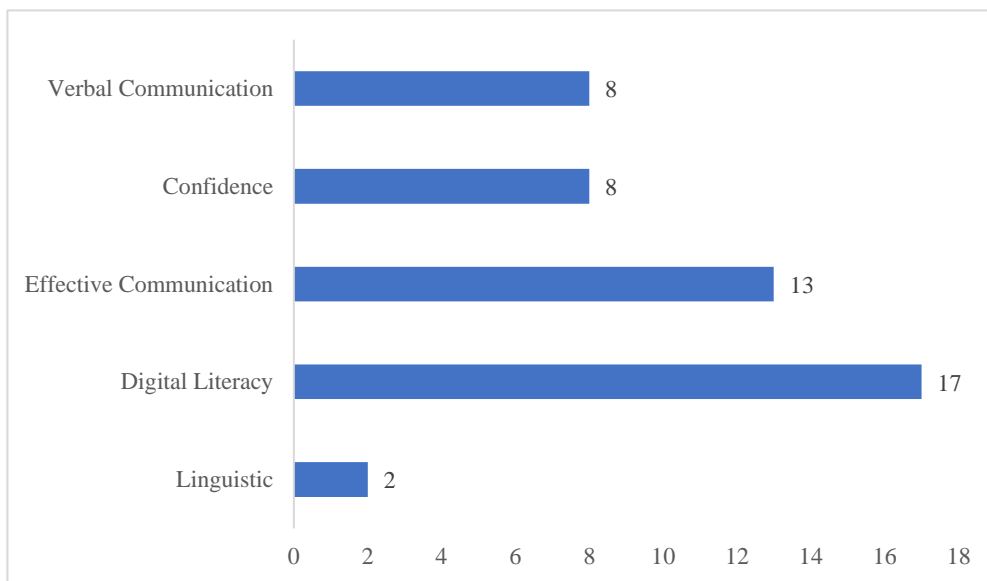


Figure 3. Impact of ICT on Communication Skills

A bar graph showing the impact of ICT on communication skills is shown in Figure 3. Five impacts of ICT on communication skills were identified and raised as topics in this systematic study as a consequence of reading and analyzing the studies that were conducted. With a total of 17 studies, the theme of ICT impact on communication skills that is most prevalent is digital literacy (Tafazoli & Meihami, 2022; Irdalisa 2022; Kaayalp et al., 2022; Sapad & Caballes, 2022; Voigt, 2021; Morales et al., 2021; Trabelsi et al., 2021; Purwaningsi et al., 2020; Mercado & Ibarra, 2019; Harits et al., 2019; Mutanga et al., 2018; Jaikaran-Doe & Doe, 2015; Gill et al., 2015; Leendertz et al., 2013; Alev et al., 2012; Heitink et al., 2012; Almås & Krumsvik, 2007).

Followed by effective communication with as many as 13 studies Tafazoli & Meihami (2022); Irdalisa (2022); Strydom et al (2021); Trabelsi et al (2021); Tondeur et al (2020); Purwaningsi et al (2020); Redmond & Lock (2019); Harits et al (2019); Ndongfack (2015); Gill et al (2015); Leendertz et al (2013); Heitink et al (2012); Almås & Krumsvik (2007), confidence with eight studies Kayaalp et al (2022); Strydom et al (2021); Redmond & Lock (2019); Mercado & Ibarra (2019); Harits et al (2019); Rodliyah (2018); Mutanga et al (2018); Heitink et al (2012), verbal communication also as many as eight studies found (Irdalisa (2022); Sapad & Caballes (2022) ; Morales et al. (2021); Redmond & Lock (2019); Mercado & Ibarra (2019); Harits et al. (2019); Rodliyah,. (2018); Alev et al. (2012)) and linguistics with only two studies (Tafazoli & Meihami (2022); Rodliyah (2018)).

## Discussion

### Verbal Communication

A person's ability to communicate verbally can be demonstrated through speaking, listening, or writing. Verbal communication is accelerated by the development of information and communication technology (ICT) when several places or platforms are present, which gives a greater impact on classroom instruction for both educators and students. Applications like Facebook, Whatsapp, and blogs are examples of platforms that are considered to not only promote communication but also instruct students in speaking and writing (Rodliyah, 2018; Alev et al., 2012).

Additionally, the incorporation of ICT in teaching and learning creates a conversation area where students may voice their opinions and ask questions about the ideas they find challenging to understand, developing their communication skills (Irdalisa, 2022; Harits et al., 2019). Furthermore, by employing audio recordings as one method of boosting students' motivation to participate in discussions, ICT integration in the discussion room during teaching and learning sessions can help students improve their listening skills (Mercado & Ibara, 2019).

ICT is also used to facilitate the student assessment process such as presentations which are necessary for the application of good communication skills (Harits et al., 2019). Additionally, by using ICT tools such as graphic calculators to make graph plots and drawing using AutoCAD software, showing that ICT is able to help students translate ideas in a more understandable visual form (Redmond & Lock, 2019).

The integration of ICT in teaching and learning also helps in forming the oral skills of educators. Educators able to take the advantage of various ICT such as PPT, LKPD, Google Site and learning videos to produce teaching materials that are more interactive in an effort to improve their ability to direct and be able to deliver subject content better (Irdalisa, 2022; Sapad & Caballes, 2022; Morales et al., 2021).

### **Confidence**

Confidence is an aspect that can hone communication skills to ensure that information and goals can be delivered well. In order to boost both educators' and students' confidence, it is crucial to incorporate ICT components into teaching and learning sessions. Nevertheless, a study by Rodliyah (2018); Heitink et al (2012) claims that not all educators are confident in their ability to convey the subject material effectively using technology-related abilities, such as video editing, because these educators are found lack sufficient TPCK knowledge.

However, educators' confidence and positive behavior towards the use of ICT is important to support student learning (Mercado & Ibara, 2019; Heitink et al., 2012). The study demonstrates that educators have high levels of confidence in using a variety of technologies during instruction for record-keeping, planning lessons, and even believing that the use of technologies will help students become more adept at using technology and locating digital learning resources (Mutanga et al., 2018). In addition, although there are challenges to ensure that students use technology well, it is important for educators to feel competent in their ability to use technology (Harits et al., 2019) because this level of confidence shows that the teacher has mastered TPK and TCK which also further illustrates that the teachers who are skillfully in explaining the benefits of using technology in content areas and choosing technology to use will improve their teaching while support student learning (Mercado & Ibara, 2019).

Therefore, it is crucial that educators have a high level of confidence in the use of ICT. The increasing of confidence level can be achieved through several ways like having experience with integrating ICT, becoming accustomed to integrating the knowledge they will use in teaching technology, judiciously seizing the chance to incorporate technology directly into the educational process based on a pedagogical approach, and displaying digital materials in the classroom (Kayaalp et al., 2022).

### **Effective Communication**

Effective communication can be achieved when a person is able to work in a group, demonstrating interpersonal value, and the ensuing communication is interactive (Azizah,

2015), and this is an important branch of communication skills. According to the analysis, the majority of studies demonstrate that successful communication can be produced by integrating ICT during teaching and learning.

Because collaborative sharing of ideas creates a forum for teacher debate and enhances both their ICT literacy and pedagogical skills, it is crucial for the development of educators' digital literacy (Almås & Krumsyik, 2007). Due to the availability of synchronous and asynchronous online collaborative options, it is claimed that this conversation space can be conducted online (Redmond & Lock 2019). This can be seen when technological elements are incorporated into various community-based platforms, like WIKI, blogs, Facebook, and Whatsapp groups, which facilitate the interaction process and enable educators to share, discuss, and write about teaching strategies and practices as well as learning planning among colleagues (Trabelsi et al., 2021; Leendertz et al., 2013; Alev et al., 2012).

Educators who assist one another while share different perspectives and experiences might engage in interactive communication. However, integration of ICT quickens this process when educators are reported to prefer working in an ICT-related field because they can benefit from one another's skills and enjoy assisting one another with ICT-related issues like using technology in an electronic learning environment (Tondeur et al., 2020). Not only that, the presence of ICT-savvy educators encourages other educators to explore the learning process in the digital world with them where educators who are more tech-savvy are always supportive of those who are less tech-savvy (Strydom et al., 2021; Ndongfack, 2015). By accepting and placing into practise principles connected to the use of ICT in teaching and learning, this at once demonstrates the significance and benefit of working collaboratively during the learning process (Strydom et al., 2021; Gill et al., 2015).

Therefore, it is evident from this that integrating ICT ideas or components into teaching and learning benefits educators, but it also necessitates that educators have empathy for students who do not have access to the same technological needs as educators (Tafazoli & Meohami, 2022). The right and suitable platform that recognized by the educators can therefore be used to encourage students to share knowledge or ideas with friends, strengthen the spirit of cooperation, provide opportunities for students to evaluate and reflect peers, even help students to cooperate with each other, and improve communication skills during presentation sessions (Irdalisa, 2022; Tafazoli & Meohami, 2022; Purwaningsih et al., 2020; Harits et al., 2019). For this reason, it is necessary for educators to be aware of the software, applications, and platforms that are appropriate for students to use.

### **Digital Literacy**

Because educators and students can use a variety of digital platforms for a variety of purposes, particularly in communication, digital literacy is crucial in the field of education. In order to use technology to enhance students' understanding of a learning topic, a teacher must have a thorough understanding of digital technology, including the internet, digital video, interactive software, and digital equipment (Mercado & Ibara, 2019; Mutanga et al., 2018). Information and resources are kept in a digital warehouse in the field of information and communication technology. Giving students the appropriate direction regarding their rights and obligations when utilizing digital tools and resources can enhance their development of literacy (Jaikaran-Doe & Doe, 2015). This is because a variety of digital platforms and ICT tools can offer students a wealth of information resources, making it simple for them to access different tools and resources for distance learning through a digital hub and to select and arrange content and digital resources that support digital learning (Voigt et

al., 2021; Mutanga et al., 2018; Jaikaran-Doe & Doe, 2015; Leendertz et al., 2013; Alev et al., 2012).

To make sure that students utilise the benefits of digital literacy effectively and in line with the learning context, the teacher's role is crucial. This is a result of the detrimental effects of ICT on digital literacy, where educators concur that when students use the internet (one of the digital learning platforms), they are able to access unhelpful websites and even fail to look for relevant content (Trabelsi et al., 2021). Hence, educators must take part in teacher education programmes that foster digital literacy among educators in order to guarantee that educators can recognize acceptable online technologies and solve any issues that may arise in the classroom in the future (Tafazoli & Meohami, 2022).

Educators and students can also use a variety of applications and the diversity of digital media to build teaching and learning that has an effective engagement space even outside of learning hours, like Whatsapp groups, as the digital world gives up a wider area for communication (Trabelsi et al., 2021; Purwaningsih et al., 2020; Jaikaran-Doe & Doe, 2015). Additionally, it can mould students' critical and creative thinking through the use of the digital environment. This results from the variety of media and digital resources that are interactive and support creativity, increasing students' desire to learn something in the form of high-level thinking skills. If a context is presented in the form of interesting media, it is able to shape creativity, innovation, and high-level thinking skills as well as encouraging the spirit of student cooperation in the learning process through various platforms like social media (Kayaalp et al., 2022; Harits et al., 2019; Mutanga et al., 2018).

Educators therefore should use digital literacy to their advantage in order to engage students because it not only creates educators who are adept at using technology, such as multimedia and visual demonstrations to show specific concepts in a subject, but also allows them to manipulate different models of scientific phenomena in the form of engaging animations (Sapad & Caballes, 2022). If educators possess strong digital literacy skills, they will be able to communicate the significance of online information to students and use synchronous learning features like file sharing, various participant feedback mechanisms, and real-time interaction or group work spaces (Morales et al., 2021; Voigt et al., 2021).

### **Linguistic**

The mastery of communication abilities can be further increased by one's capacity to learn a language. Therefore, students can more effectively study the language for communication by integrating ICT into the language topic in order to communicate through Facebook and Whatsapp groups (Rodliyah, 2018).

In this age of globalization, digital platforms like social media expose students, in particular, to the variety of languages spoken around the world. In addition, schools and universities now offer foreign language courses that help students learn languages other than their mother tongue. However, some students feel awkward or nervous speaking in foreign languages when discussing topics. Thus, there are online learning platforms that provide forums for debate and host guest speakers to encourage hesitant students to strike up a conversation in a foreign language (Tafazoli & Meohami, 2022).

Hence, students can be motivated and confident to use the language thanks to the incorporation of ICT in teaching and learning (Rodliyah, 2018). To keep students' interest and attention, educators must constantly vary the ICT use that is suited to the instructional situation, especially in areas related to linguistics.

## Conclusion

ICT has becoming one of the essential tools in teaching and learning where it does plays an important role in education system across the world. Hence, this study conduct a systematic review on the impact of ICT on communication skills that also containing analysis of TPACK knowledge elements. Analysis of trend demographically on 23 selected articles shows that the TPACK framework has been used in the previous studies where the review concluded that there is increasing number of studies, according to the pattern of knowledge foci over time (Period I – Period III). Therefore, it demonstrates the significance of placing a knowledge-based emphasis on ICT-integrated teaching and learning practices and strategies that also eventually have an impact towards educators' and students' communication skills.

Also, thematic analysis was conducted, resulting in five themes: (i) verbal communication; (ii) confidence; (iii) effective communication; (iv) digital literacy; and (v) linguistics where most of the articles shows that digital literacy has been impacted the most when ICT is utilized during teaching and learning sessions. The review concluded that even though there are challenges found such as the educators' confidence in the use of ICT and the students' negative attitudes towards using ICT tools, which should be used as much as possible in their learning, the integration of ICT during teaching and learning sessions has a positive impact on communication skills in various ways.

However, the review also concluded that there is imbalance between sample group based on the analysis of selected articles. When compared to educators, very few samples were gathered from the sample group of students. Thus, there is a need for further research on the impact of ICT that also involves TPACK framework to explore how much it affects students' communication skills or any other relevance skills suit to the world changes nowadays.

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