

ORIGINAL RESEARCH ARTICLE

Teachers' sense of competence in terms of ICT use: the case of secondary school teachers

El Mustapha Baytar*, Hayat Elyacoubi, Nadia Saqri and Lynda Ouchaouka

Multidisciplinary Laboratory in Educational Sciences and Training Engineering, Higher Normal School, Hassan II University of Casablanca, 50069, Casablanca, Morocco

(Received: 11 August 2022; Revised: 7 January 2023; Accepted: 16 April 2023;

Published: 26 May 2023)

In the current digital age, the integration of information and communication technologies (ICT) into teaching practices has become a determining factor in learning quality. The teachers' digital competence issue has come back to the forefront because of the schools' closure due to the COVID-19 pandemic. Our study aims to assess the sense of competence in terms of ICT use of a sample of 260 secondary school teachers in the Directorate of Education in Rhamna, Morocco, by adopting a quantitative methodology. Our findings suggested that only 26.1% of the individuals in our sample reported they feel effectively competent. The pandemic made a significant change in teachers' perceptions of the importance of ICT integration and training in the field. Moreover, a cross-analysis highlighted significant relationships between the sense of competence in terms of ICT use and six independent variables: continuous training, learning readiness, gender, age, teaching experience, and school subject. Our findings would be helpful for policymakers to guide educational policies by focusing on ICT continuous training to enhance teachers' digital competence.

Keywords: ICT; educational technology; pedagogical uses; Lemke and Coughlin framework

Introduction

Information and communication technologies (ICT) are increasingly used in all areas of human activity and are having a growing influence on the world of education. Thus, schools cannot afford to remain disengaged. Technology has invaded teachers' daily lives (Şahal and Ozdemir 2020), but it has not yet yielded the desired impact on their practice in the classroom. Therefore, training on digital competence represents one of the main challenges teachers face as they strive to integrate ICT into their teaching practices (Garzón-Artacho *et al.* 2021). Hence, teachers are required to have the digital attitudes and skills that enable them to design active and innovative teaching strategies. A well-trained teacher is more likely to integrate ICT in a relevant way (Hsu 2010). The Covid-19 lockdown has revealed the vulnerability of many educational systems around the world (Lawrence and Fakuade 2021). Schools' reactions ranged from conservative to completely innovative (Stracke *et al.* 2022).

*Corresponding author. Email: elmustapha.baytar@enscasa.ma

The concept of digital competence has been used extensively in the literature related to ICT use to assess the extent to which teachers are able to integrate ICT into their teaching practice. This competence is described in the literature by several designations, such as digital literacy, information literacy, digital skills, technology skills, ICT skills, teachers' confidence in using ICT, etc. (Perifanou *et al.* 2019). In the same context, in order to assess the digital competence of the individuals in our sample, we measured their 'sense of competence' in terms of ICT use.

Moreover, while conducting our literature review, we have noted the use of a range of terms that often refer to teachers' ICT continuous training, such as continuing education (e.g. Artacho *et al.* 2020), continuing/continuous professional development (e.g. Holmes 2013), lifelong learning (e.g. Garzón-Artacho *et al.* 2021), and pre-service/in-service training (e.g. Panagiotis *et al.* 2011). Our understanding of continuous training in this paper is embodied in Bjursell's definition of lifelong learning: '[...] it comprises "cradle-to-grave" learning throughout a person's life and includes formal, non-formal, and informal learning' (Bjursell 2020, p. 675). Likewise, the neologism of 'apprenance' which reflects the same understanding, has been widely addressed in French literature by P. Carré (Frétigné 2021).

Current literature has thus tried to build theoretical models describing the process of pedagogical integration of ICT. The common denominator between these models is that they attempt to categorise teachers' skills along a continuum of progressive development regarding ICT integration. This is carried out by describing each stage of the integration process, often ranging from non-use to innovative use. Hence, applying these models could provide insight into teachers' digital competence level, even if each model has its own conception of this competence. The following are three examples of theoretical frameworks for integrating ICT into teaching practices:

The Digital Competence of Educators framework (DigCompEdu) (2017)

The DigiCompEdu framework describes 22 specific digital skills for educators, constituted of six domains (Redecker 2017, p. 9). The framework's core is described in domains 2–5, where technologies are incorporated in a pedagogically meaningful way (Ghomi and Redecker 2019). According to Ghomi and Redecker (2019), it describes six different levels of an educator's digital competence: Newcomers (A1) and explorers (A2) who have basic digital skills, Integrators (B1) and experts (B2) who already use digital technologies in their practice in multiple ways, and finally, Leaders (C1) and Pioneers (C2) who are able to criticise and develop existing practices.

Concern-Based Adoption Model (1974)

This framework was elaborated by Hall in 1974 (Hall 1974). It displays three main techniques to describe the process of implementing an innovation. The Stages of Concerns (SoC) questionnaire is one of these three tools. It describes teachers' concerns, that is, feelings regarding integrating an innovation (George, Hall, and Stiegelbauer 2013, p. ix). It suggests a continuum of six stages (George, Hall, and Stiegelbauer 2013, p. 8): (0) Awareness stage, (1) Informational stage, (2) Personal stage, (3) Management stage, (4) Consequence stage, (5) Collaboration stage, (6) Refocusing stage. Generally, a teacher often begins with higher intensity of concern in the lower stages (1 and 2) until developing a higher level of concern in the higher stages (5 and 6)

through continuous progress (Dele-Ajayi, Fasae, and Okoli 2021). Although it is an old theoretical model, the CBAM is still used in recent research which considers the integration of technology in education as an innovation (e.g. Alnujaidi 2021; Ashrafzadeh and Sayadian 2015; Dele-Ajayi, Fasae, and Okoli 2021; Hao and Lee 2015; St-Laurent and Poellhuber 2018).

The theoretical model of Lemke and Coughlin (1998)

It is a competence model suggested by Lemke and Coughlin (1998) that describes the necessary competencies for a teacher to use ICT effectively in his or her teaching practice (Bérubé and Poellhuber 2005, p. 33). These competencies are described along a continuum of three stages (Coughlin and Lemke 1999, p. 11):

Entry

Teachers at this stage are aware of the potential of ICT to support their practice. However, the reality of their teaching does not reflect this belief. Teachers' access to ICT is low as they still need to gain the necessary skills to integrate them effectively and thus make their teaching more meaningful.

Adaptation

ICT are increasingly present in teachers' pedagogical practices at this stage. However, despite succeeding in developing their digital competence, they mainly try to '*automate, accelerate and improve*' the already existing teaching practices.

Transformation

ICT bring radical changes to teaching practices at this stage. They change the roles of teachers and learners as well as their relationships. In addition, teachers are implementing creative practices that were not possible before.

In the same context, our study used a validated questionnaire based on Lemke and Coughlin's theoretical model (1998) to measure teachers' sense of competence according to the three levels mentioned earlier. Likewise, in our literature review, we found several studies attempting to assess teachers' digital competence using different theoretical models. It is worth noting that few studies have addressed the digital competence issue during the Covid-19 crisis. Moreover, we have noticed a lack of studies addressing this issue in the Moroccan context, either before or during the pandemic. The same remark has been raised by Benali, Kaddouri, and Azzimani (2018).

Based on the DigCompEdu framework, a study was conducted in the Moroccan context on a sample of 160 English language teachers (Benali, Kaddouri, and Azzimani 2018). High mean scores were registered in digital resource selection, teaching, and reflective practice. Differences in digital competence were significant regarding the digital teaching confidence level and teaching experience. Moreover, a survey of 251 Greek primary and secondary school teachers conducted just before the closure of schools due to Covid-19 (Fernández-Sánchez, Dominguez, and Sosa-Díaz 2021) found weaknesses in both the digital competence of teachers and continuous training in ICT, which explains, according to the study, the difficulties encountered by teachers

during the lockdown period. Another study attempted to explore the ICT uses of 806 secondary and primary school teachers amid the Covid-19 crisis (March to May 2020) (Perifanou, Economides, and Tzafilkou 2021). According to its results, teachers found it difficult to use ICT for specific uses, such as final assessment of students, reviewing pedagogical resources, and feedback. Furthermore, another study has adopted the Concerns-Based Adoption Model (CBAM) to assess the digital competence of 340 Nigerian teachers by identifying statistical frequencies along a continuum of six concern stages (Dele-Ajayi, Fasae, and Okoli 2021). The overall profile suggests that teachers do not use ICT in their teaching practices. In general, the non-users' concerns were highest at the first three stages (awareness, informational, and personal) and lowest at the last three stages (consequence, collaboration, and refocusing). In addition, statistically significant differences were found, in the latter study, between the SoC on the one hand and teaching experience and age on the other hand.

Within this framework, we investigate in this study the level of teachers' sense of competence in terms of ICT use and whether or not continuous training contributes to improving this sense. Moreover, our research was conducted in an unprecedented context marked by the constraints of the Covid-19 pandemic. Thus, we investigate how this crisis would impact teachers' perceptions and attitudes towards ICT use and training. Bearing in mind all these questions, the objectives of this study are:

Objective 1. Highlighting the impact of the Covid-19 pandemic on secondary school teachers' perceptions of the importance of integrating ICT and training in this area.

Objective 2. Measuring secondary school teachers' sense of competence in terms of ICT use and identifying its relationship with the main variables of our survey.

Method

Participants

Our target population consists of secondary school teachers of the Directorate of Education in Rhamna, which belongs to the Regional Academy of Education – Marrakech-Safi, one of the 12 regional academies in the Kingdom of Morocco. The final sample comprised 260 secondary school teachers. Their consent was obtained when filling out the questionnaire. It was clear to them what the objectives of the research were. We respected their anonymity and confidentiality. The following table (Table 1) illustrates details of teachers' demographics.

Instrument

To measure teachers' sense of competence, we drew on the questionnaire developed by Lebrun, Lison, and Batier (2016) based on the theoretical model of Lemke and Coughlin (1998) of ICT integration. The questionnaire of the sense of competence in terms of ICT use is made up of 22 items distributed over three levels (Entry – Adaptation – Transformation). The 22 items are distinguished as follows: items from 1 to 11 for Entry level (11 items), items from 12 to 17 for Adaptation level (six items), and items from 18 to 22 for Transformation level (five items). A Likert scale was adopted for answers with three options: (1) *NO = I do not feel competent at all*, (2) *YES, I think so = I think I am competent*, and (3) *YES, I do = I feel competent and I perform this action without any problem*. Moreover, closed-ended choice questions

Table 1. Participants' demographics.

Variables	Measurement groups	<i>n</i>	%	Variables	Measurement groups	<i>n</i>	%	
Gender	Male	190	73.1	The last diploma	Baccalaureate	4	1.5	
	Female	70	26.9		Baccalaureate + 2	12	4.6	
Age (years)	20–30	60	23.1		Bachelor	158	60.8	
	31–40	112	43.1		Master	74	28.5	
	41–50	56	21.5		Doctorate	12	4.6	
	51–60	31	11.9		1–5	67	25.8	
School subject	61 and over	1	0.4		Teaching experience (years)	6–15	118	45.4
	Literary	150	57.7			16–25	61	23.5
	Scientific	84	32.3			26 and over	14	5.4
Workplace	Activity	26	10		Teaching cycle	Middle school	139	53.5
	Urban	168	64.6	High school		121	46.5	
	Rural	92	35.4					

were added to gather data about the characteristics of the individuals in our sample, explore teachers' continuous training, and highlight the impact of the Covid-19 crisis on teachers' perception regarding ICT integration.

Concerning the validation process, we followed a psychometric approach to validate the questionnaire content by seeking the expertise of three referees, who are ICT specialists and who have Bachelor's degrees in Psychology. They checked that each item belongs to the level it represents, that the items are linguistically correct and understandable, and their effectiveness in measuring what they are supposed to measure. On the other hand, we calculated Cronbach's alpha coefficient to assess the instrument's reliability. Thus, Cronbach's alpha coefficient for the whole questionnaire was 0.960, and those for each of the three dimensions, Entry, Adaptation, and Transformation, were respectively 0.919, 0.898, and 0.924. Therefore, these optimal Cronbach's alpha coefficient values ensured our survey's proper conduct. Furthermore, to ensure the impact of an item on the reliability of the questionnaire, we have calculated Cronbach's alpha coefficient for the questionnaire in case of deletion of this item (Table 2). Since all the values obtained, in the case of deletion of each item, did not exceed the global coefficient (0.96), no item undermines the reliability of the questionnaire. Therefore, we decided to keep all items.

Data collection and analysis

Two modes of administration were adopted to collect data via the questionnaire: direct administration, which consisted of distributing paper questionnaires, and online administration, which consisted of sharing links to the questionnaire developed in Google Forms. The questionnaire was written in Arabic and French for both modes of administration. In sum, we judged 106 paper questionnaires and 154 digital response forms to be valid and serious. Thus, the final size of our sample was *N* = 260. It is worth noting that the questionnaire was administered just after the first easing of pandemic-related restrictions (April 2021).

The analysis of the collected data was carried out to meet the objectives we mentioned above. Thus, we proceeded to two modes of analysis using SPSS statistical

Table 2. Cronbach's alpha coefficient in case of deletion of each item.

Items	CA*	Items	CA*
1. Using a computer.	0.959	12. Integrating videos into my teaching.	0.958
2. Using one of these peripherals: video projector, camera, scanner, ...	0.959	13. Using the slide show to structure my teaching sessions.	0.958
3. Playing a video on my computer.	0.960	14. Participating actively in virtual meetings.	0.958
4. Modifying a video on my computer.	0.958	15. Organizing my teaching using the 'Teams platform'.	0.957
5. Creating a slide show (PPT ...).	0.958	16. Integrating web resources into my teaching.	0.958
6. Using virtual meeting tools (Skype, Zoom, Google meet ...).	0.958	17. Using Exercisers in my teaching.	0.958
7. Using the 'Teams' learning platform**.	0.957	18. Accompanying students in the creation of multimedia resources (videos ...).	0.958
8. Searching for information on the web.	0.960	19. Training my students to use the technologies involved in my teaching.	0.958
9. Managing emails (Spam, filters ...).	0.960	20. Communicating about my techno-pedagogical practices.	0.958
10. Handling an exercise editor.	0.957	21. Supervising research on techno-pedagogical practices for learning.	0.959
11. Handling a web editor.	0.957	22. Justifying the interest in my technological and pedagogical approach.	0.958

*Cronbach's alpha coefficient.

**A platform created by the Ministry of Education in the wake of the pandemic.

software version 22. We carried out a flat sorting analysis to make a descriptive statistics of the collected data and a cross-analysis to highlight possible relationships between our survey variables.

Results

Continuous training in ICT

To the question '*Have you received any type of continuous training in using ICT?*' roughly 52% of the participants answered Yes. As for the source of this training, about two-thirds of the participants said that it was provided by the Ministry of Education, and about half of them have engaged in a self-training process. Moreover, 'courses' and 'workshops' were the most common forms of formal continuous training, according to more than half of the respondents.

Furthermore, more than half of the individuals in the sample, who are at least somewhat satisfied with their level of competence in terms of using ICT in their practice, declared that this competence is mainly linked to non-formal training that corresponds to their self-training. In addition, among people who declared to be engaged in a self-training process in terms of ICT use, 42% of them consider themselves '*avid learners*'.

Perceptions' change regarding ICT integration at the time of the pandemic

Before the pandemic, about 15% of teachers (Figure 1) considered that it was not important for a teacher to be able to use ICT in the classroom for her/his teaching activities, and 32% of them considered that it was rather very important. While during the pandemic, the first portion decreased to 6%, and the second increased to 78%. As for learners, 18% of the participants considered, before the pandemic, that it was not important for the learners to use ICT in their classroom learning activities, and 27% of them thought that it was rather very important. While during the pandemic, the first portion decreased to 6%, and the second increased to 69%. In the same sense, among the 180 individuals, that is, 69% in the sample, who responded to the question, 'If you did not feel fully competent to use ICT during the pandemic, do you intend to fill your gaps by engaging in a self-training process?', 92% answered affirmatively.

The sense of competence regarding the use of ICT

As a first step, we present the distribution of the 260 participants according to their global scores obtained for all the sense of competence questionnaire items (Figure 2). The results suggest that 31.5% of the individuals do not feel competent at all in terms of ICT use, while 26.1% feel effectively competent.

However, these results gave us an overarching idea about the teachers' digital competence level. Thus, to situate the individuals in the sample on the continuum of competence suggested by Lemke and Coughlin's theoretical model (1998) (Entry, Adaptation, Transformation), another work of grouping the participants according to the three levels of the questionnaire was necessary (Figure 3). Therefore, the results of this work indicated that the highest portion of the individuals who reported they feel effectively competent in terms of ICT use was observed in the first level (Entry), that is, 40%. Then, a portion of 30.8% was observed in the second level (Adaptation). Finally, the lowest portion was in the last level of transformation (17.3%), which is theoretically a level of innovative practices.

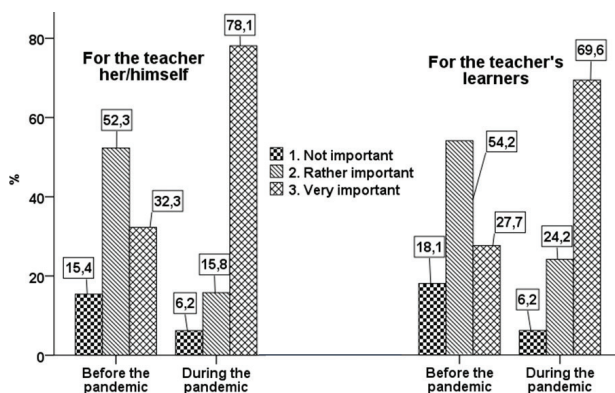


Figure 1. Teacher's perception of the importance of information and communication technologies (ICT) integration, both for her/himself and for her/his learners before and during the pandemic.

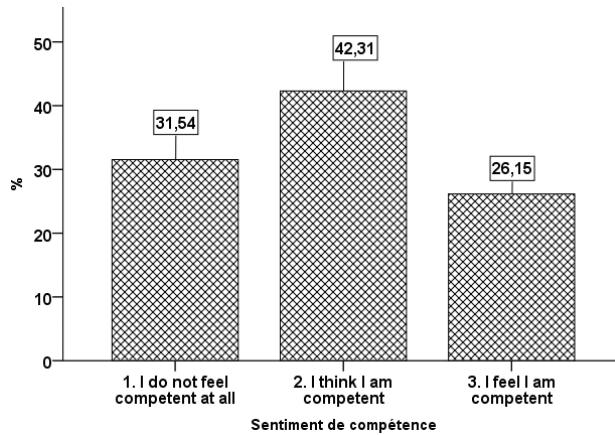


Figure 2. The sense of competence according to the global score of the questionnaire.

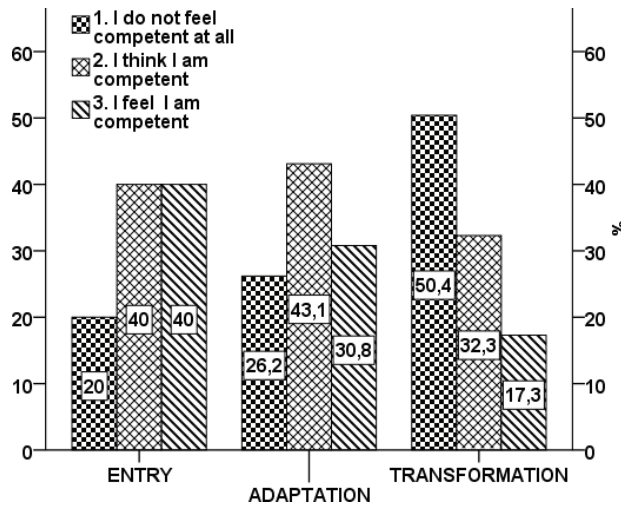


Figure 3. The sense of competence according to the three levels of the questionnaire.

The sense of competence and the main independent variables

Using the independent samples *t*-test, we tested the relationship between the sense of competence on one side and all the independent variables with two measurement groups on the other side. The differences were statistically significant for three variables ($p < 0.05$): continuous ICT training, learning readiness, and gender (Table 3). Hence, it can be concluded that:

- People who have benefited from ICT training feel significantly more competent than those who have not;
- People who consider themselves avid learners feel significantly more competent than those who do not;
- Males significantly more than females declared themselves competent in using ICT.

In the same way, as earlier, we also tested, using the ANOVA test (Analysis of variance), the relationship between teachers' sense of competence in terms of ICT use and all other independent variables with more than two measurement groups. Differences were statistically significant for three variables: teaching experience, age, and school subject. Furthermore, to specify which pairs of groups have a significant difference, we carried out a post hoc test (the Least Significant Difference test). Below is an example of an LSD test regarding teaching experience (Table 4). The LSD test results suggested that recent hires (1–5 years) feel significantly more competent than more experienced hires (16–25; 26 years over).

Likewise, as for the age and the school subject variables, and following the same procedure, results have suggested that:

- Individuals in the youngest age ranges, namely 20–30, 31–40, and 41–50, feel significantly more competent than individuals in the 51–60 age range ($p = 0.02 < 0.05$).
- Teachers in science and activity school subjects feel significantly more competent in terms of ICT use than those in literary school subjects ($p = 0.04 < 0.05$).

Discussion

Our study was an attempt to measure teachers' sense of competence in terms of ICT use and to ascertain a potential relationship between this dependent variable

Table 3. The sense of competence and the two measurement groups variables.

N = 260	*CT (%)		**LR (%)		Gender (%)	
	Yes	No	Yes	No	M	F
1. I do not feel competent at all	37.8	62.2	75.6	24.4	62.2	37.8
2. I think I am competent	58.2	41.8	61.8	38.2	76.4	23.6
3. I feel I am competent	57.4	42.6	45.6	54.4	80.9	19.1
* <i>t</i> -test ICT continuous training:	<i>M</i> (No) = 1.83		<i>M</i> (Yes) = 2.06		<i>p</i> = 0.013	
** <i>t</i> -test Learning readiness:	<i>M</i> (No) = 1.81		<i>M</i> (Yes) = 2.17		<i>p</i> = 0.000	
<i>t</i> -test Gender:	<i>M</i> (M) = 2.02		<i>M</i> (F) = 1.74		<i>p</i> = 0.009	

ICT, information and communication technologies.

Table 4. LSD test (multiple comparison).

(I)	(J)	MD (I-J)	Sig.	(I)	(J)	MD (I-J)	Sig.
	6–15	0.162	0.161		1–5	-0.316*	0.018
1–5	16–25	0.316*	0.018	16–25	6–15	-0.154	0.194
	26 and over	0.477*	0.032		26 and over	0.160	0.472
	1–5	-0.162	0.161		1–5	-0.477*	0.032
6–15	16–25	0.154	0.194	26 and over	6–15	-0.315	0.140
	26 and over	0.315	0.140		16–25	-0.160	0.472

* The mean difference (MD) is significant at the 0.05 level.
LSD, the Least Significant Difference test.

and other independent variables (O2). Moreover, the conduct of this study during the covid-19 crisis was an opportunity to examine a potential change in these teachers' perceptions and attitudes towards the use of ICT and training in this field (O1).

One of our study's particularities is that it was conducted amid the Covi-19 crisis, so it was an opportunity to identify its impact on teachers' perceptions and attitudes towards the importance of ICT use by asking about their perception before and during the pandemic. Many studies have found connections and affinities between teachers' attitudes and their digital competence (Yusuf and Balogun 2011). People with positive attitudes are more likely to integrate ICT into their teaching practice (Teo 2008). Our results have explicitly indicated the pandemic impact in favour of the importance of ICT as perceived by teachers, whether for their teaching or for their learners' activities. These findings would be relevant to the Ministry of Education. It should endeavour to foster a supportive learning environment for teachers in both formal and non-formal settings since our results showed that formal training is mostly provided by this Ministry, and the majority of teachers are engaged in a self-training process for their professional development. Moreover, it would be helpful if the '*unified system for validating individuals' cognitive and professional learning*', recommended by the 2015–2030 strategic vision (CSEFRS Maroc 2015, p. 71), is implemented as soon as possible to promote teachers' lifelong learning.

Furthermore, our results of the sense of competence questionnaire indicated that about a quarter of the individuals in our sample feel effectively competent (26.1%). In addition, according to the three questionnaire levels, the highest portion of these individuals was in the first level of Entry (40%) which is theoretically a basic level. These findings are consistent with Perifanou *et al.* results (2019), which stressed a lack of teachers' digital competencies that include not only ICT use but also the capability to integrate technology through innovative methods and creative ideas. In the same context, the results of Benali, Kaddouri, and Azzimani study (2018), which was conducted in the Moroccan context and adopted the Digi-CompEdu framework, indicated that the majority of participants (English language teachers) scored in the intermediate levels of digital competence (B1 and B2). In addition, our findings are reflected, with similar trends, in other studies in different contexts, especially when it comes to the dimensions of digital competence that require creative and innovative abilities, despite using various measurement tools and labels of digital competence (e.g. Artacho *et al.* 2020; Dele-Ajayi, Fasae, and Okoli 2021; Garzón-Artacho *et al.* 2021).

Furthermore, our study suggested significant relationships between teachers' sense of competence in terms of ICT use and six other independent variables. Firstly, people who have benefited from ICT training feel significantly more competent than those who have not. Other studies have suggested the same finding. (e.g. Artacho *et al.* 2020; Hsu 2010; Perifanou *et al.* 2019). Secondly, differences in the sense of competence based on teaching experience were significant. Recent hires (1–5 years) feel significantly more competent than more experienced hires (16–25; 26 years over). This conclusion is backed up by other studies' findings (e.g. Benali, Kaddouri, and Azzimani 2018; Dele-Ajayi, Fasae, and Okoli 2021). Thirdly, significant differences were found regarding teachers' learning readiness. Individual characteristics and attitudes towards implementing ICT truly influence digital competence (Benali, Kaddouri, and Azzimani 2018). Fourthly, significant differences

were indicated in connection with individuals' age. Thus, those in the youngest age ranges (20–30, 31–40, and 41–50) feel more competent than individuals in the 51–60 age range. '*This is arguably a generational issue, not simply a pedagogical one*' (Tan and McWilliam 2009, p. 9). Technology is fully integrated into young people's lives compared to earlier when individuals had difficulties dealing with the electronic world (Tapscott 2009, p. 7). However, Perifanou *et al.* (2019) found no correlation between teachers' age and their confidence in using ICT. Fifthly, significant differences in terms of gender were concluded, where more male than female participants declared themselves to be more competent in using ICT. A surprising remark is that none of the studies we consulted indicated significant differences in digital competence regarding gender (e.g. Benali, Kaddouri, and Azzimani 2018; Dele-Ajayi, Fasae, and Okoli 2021; Garzón-Artacho *et al.* 2021; Sánchez Prieto *et al.* 2020). Lastly, it was found that teachers in science and activity school subjects feel significantly more competent in terms of ICT use than those in literary school subjects. None of the studies we reviewed have raised this point or adopted our classification for school subjects.

Conclusion

Teacher digital competence has been the subject of several studies using different labels and measurement tools in different contexts. Our study is part of this scientific dynamic. Its relevance is due to its conduct amid the Covid-19 crisis. In order to meet its two research objectives, our study has adopted a quantitative approach.

Thus, the present research suggested that pandemic-related constraints, especially school closures during the lockdown, have made a significant change in teachers' attitudes towards the importance of the integration of ICT and of training in that field. Moreover, only 26.1% of the individuals in our sample reported that they feel effectively competent. Their distribution according to the three levels of the sense of competence questionnaire showed that the highest portion (40%) performs basic uses of ICT (Entry), and only 17.3% performs innovative uses (Transformation). In addition, a cross-analysis highlighted the impact of continuous training and readiness learning on teachers' sense of competence. Likewise, significant relationships were found between the sense of competence in terms of ICT use and four other participants' attributes: gender, age, teaching experience, and school subject.

Finally, it should be noted that this paper's results do not claim to be exhaustive. We have tried to present some answers to our research questions that would benefit from being more in-depth. We are aware of our research limitations related mainly to the reduced sample size, the limited geographical area of study, and the use of a self-perception questionnaire where the risk of inducing subjective responses is considerable, which could affect the quality of the results. Thus, it would be difficult to generalise these results to the entire kingdom territory. However, such research can still be helpful for policymakers to guide their educational policies. Hence, to overcome the limitations mentioned earlier, it would be interesting to extend the reflection of the present paper to further research by adopting a qualitative methodology or by conducting action research. Likewise, it might be interesting to understand what role other stakeholders, such as the learner and school leaders, would play in fostering teachers' digital competence.

References

- Alnujaidi, S. (2021) 'Adoption of mobile assisted language learning (Mall) in Saudi Arabian EFL classrooms', *Journal of Language Teaching and Research*, vol. 12, no. 2, pp. 312–323. doi: 10.17507/jltr.1202.13
- Artacho, E. G., et al., (2020) 'Teacher training in lifelong learning-the importance of digital competence in the encouragement of teaching innovation', *Sustainability (Switzerland)*, vol. 12, no. 7, p. 2852. doi: 10.3390/su12072852
- Ashrafzadeh, A. & Sayadian, S. (2015) 'University instructors' concerns and perceptions of technology integration', *Computers in Human Behavior*, vol. 49, pp. 62–73. doi: 10.1016/j.chb.2015.01.071
- Benali, M., Kaddouri, M. & Azzimani, T. (2018) 'Digital competence of Moroccan teachers of English', *International Journal of Education and Development Using ICT*, vol. 14, no. 2, pp. 99–120.
- Bérubé, B. & Poellhuber, B. (2005) 'Un référentiel de compétences technopédagogiques destiné au personnel enseignant du réseau collégial', *Regroupement des collèges PERFORMA*, [online] Available at: <http://cmap.ccdmd.qc.ca/rid=1LVLXNCLS-1ZK34T7-4WT/referentiel.pdf>
- Bjursell, C. (2020) 'The COVID-19 pandemic as disjuncture: lifelong learning in a context of fear', *International Review of Education*, vol. 66, nos. 5–6, pp. 673–689. doi: 10.1007/s11159-020-09863-w
- Coughlin, E. & Lemke, C. (1999) *Professional Competency Continuum: Professional Skills for the Digital Age classroom*, Milken Exchange on Education Technology, [online] Available at: https://www.mff.org/assets/Uploads/newsroom_archive/publications/ME159.pdf
- CSEFRS Maroc. (2015) 'la Vision stratégique 2015–2030', *Conseil supérieur de l'éducation, de la formation et de la recherche scientifique*, [online] Available at: https://www.csefrs.ma/wp-content/uploads/2017/09/Vision_VF_Fr.pdf
- Dele-Ajayi, O., Fasae, O. D. & Okoli, A. (2021) 'Teachers' concerns about integrating information and communication technologies in the classrooms', *PLoS One*, vol. 16, no. 5, p. e0249703. doi: 10.1371/journal.pone.0249703
- Fernández-Sánchez, M. R., Dominguez, F. I. R. & Sosa-Díaz, M. J. (2021) 'The educational integration of digital technologies preCovid-19: lessons for teacher education', *PLoS One*, vol. 16, no. 8, p. e0256283. doi: 10.1371/journal.pone.0256283
- Frétiigné, C. (2021) 'Carré, P. (2020). Pourquoi et comment les adultes apprennent. De la formation à l'apprenance', *Recherche et formation*, [online] Available at: <https://journals.openedition.org/rechercheformation/6615>
- Garzón-Artacho, E., et al., (2021) 'Teachers' perceptions of digital competence at the lifelong learning stage', *Heliyon*, vol. 7, no. 7, p. e07513. doi: 10.1016/j.heliyon.2021.e07513
- George, A. A., Hall, G. E. & Stiegelbauer, S. (eds) (2013) *Measuring Implementation in Schools: The Stages of Concern Questionnaire*, 3rd printing, SEDL, Austin, TX.
- Ghomi, M. & Redecker, C. (2019) 'Digital competence of educators (DigCompEdu): development and evaluation of a self-assessment instrument for teachers' digital competence', *Proceedings of the 11th International Conference on Computer Supported Education*, SCITEPRESS, Heraklion, pp. 541–548. doi: 10.5220/0007679005410548
- Hall, G. E. (1974) *The Concerns-Based Adoption Model: A Developmental Conceptualization of the Adoption Process within Educational Institutions*, The University of Texasat, [online] Available at: <https://eric.ed.gov/?id=ED111791>
- Hao, Y. & Lee, K. S. (2015) 'Teachers' concern about integrating Web 2.0 technologies and its relationship with teacher characteristics', *Computers in Human Behavior*, vol. 48, pp. 1–8. doi: 10.1016/j.chb.2015.01.028
- Holmes, B. (2013) 'School teachers' continuous professional development in an online learning community: lessons from a case study of an eTwinning learning event', *European Journal of Education*, vol. 48, no. 1, pp. 97–112. doi: 10.1111/ejed.12015

- Hsu, S. (2010) 'The relationship between teacher's technology integration ability and usage', *Journal of Educational Computing Research*, vol. 43, no. 3, pp. 309–325. doi: 10.2190/EC.43.3.c
- Lawrence, K. C. & Fakuade, O. V. (2021) 'Parental involvement, learning participation and online learning commitment of adolescent learners during the COVID-19 lockdown', *Research in Learning Technology*, vol. 29. doi: 10.25304/rlt.v29.2544
- Lebrun, M., Lison, C. & Batier, C. (2016) 'Les effets de l'accompagnement technopédagogique des enseignants sur leurs options pédagogiques, leurs pratiques et leur développement professionnel', *Revue internationale de pédagogie de l'enseignement supérieur*, vol. 32, no. 1. doi: 10.4000/ripes.1028
- Lemke, C. & Coughlin, E. (1998) *Technology in American schools: seven dimensions for gauging progress. A policymaker's guide*, Milken Exchange on Education Technology, [online] Available at: <https://eric.ed.gov/?id=ED460677>
- Panagiotis, G., *et al.*, (2011) 'Informatics and communication technologies (ICT) and in-service teachers' training', *Review of European Studies*, vol. 3, no. 1, pp. 2–12. doi: 10.5539/res.v3n1p2
- Perifanou, M., *et al.*, (2019) 'Investigating teachers' confidence and training needs on digital literacy across four European countries', *INTED2019 Proceedings*, Valencia, pp. 6808–6817.
- Perifanou, M., Economides, A. A. & Tzafilkou, K. (2021) 'Teachers' digital skills readiness during COVID-19 pandemic', *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 8, pp. 238–251. doi: 10.3991/ijet.v16i08.21011
- Redecker, C. (2017) 'European framework for the digital competence of educators: DigCompEdu', *Joint Research Centre (Seville site)*, [online] Available at: <https://ideas.repec.org/p/ipt/iptwpa/jrc107466.html>
- Şahal, M. & Ozdemir, A. Ş. (2020) 'Pre-service primary teachers' views and use of technology in mathematics lessons', *Research in Learning Technology*, vol. 28. doi: 10.25304/rlt.v28.2302
- Sánchez Prieto, J., *et al.*, (2020) 'Gender and digital teaching competence in dual vocational education and training', *Education Sciences*, vol. 10, no. 3, p. 84. doi: 10.3390/educsci10030084
- St-Laurent, S. F. & Poellhuber, B. (2018) 'Change process of two postsecondary teachers in the early adoption of an active learning classroom', *Frontiers in ICT*, vol. 5, p. 12. doi: 10.3389/fict.2018.00012
- Stracke, C. M., *et al.*, (2022) 'Responding to the initial challenge of the COVID-19 pandemic: analysis of international responses and impact in school and higher education', *Sustainability (Switzerland)*, vol. 14, no. 3, p. 1876. doi: 10.3390/su14031876
- Tan, J. P.-L. & McWilliam, E. (2009) 'From literacy to multiliteracies: diverse learners and pedagogical practice', *Pedagogies: An International Journal*, vol. 4, no. 3, pp. 213–225. doi: 10.1080/15544800903076119
- Tapscott, D. (ed) (2009) *Grown Up Digital How the Net Generation Is Changing Your World*, McGraw Hill Professional.
- Teo, T. (2008) 'Pre-service teachers' attitudes towards computer use: a Singapore survey', *Australasian Journal of Educational Technology*, vol. 24, no. 4, pp. 413–424. doi: 10.14742/ajet.1201
- Yusuf, M. O. & Balogun, M. R. (2011) 'Student-teachers' competence and attitude towards information and communication technology: a case study in a Nigerian university', *Contemporary Educational Technology*, vol. 2, no. 1, pp. 18–36. doi: 10.30935/cedtech/6041