The digital competence of the rural teacher of primary education in the mentoring process: a study by teaching speciality and gender

Francisco David Guillén-Gámez
Department of Didactics and Educational Organization, Faculty of Education Sciences, University of Málaga, Málaga, Spain
Ernesto Colomo-Magaña
Department Theory and History of Education, Faculty of Education Sciences, University of Málaga, Málaga, Spain
Julio Ruiz-Palmero
Department of Didactics and Educational Organization, Faculty of Education Sciences, University of Málaga, Málaga, Spain, and
Łukasz Tomczyk
Institute of Education, Jagiellonian University, Warsaw, Poland

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Abstract

Purpose – To know the digital competence of rural teachers to carry out the tutoring process with members of the educational community through digital resources (teacher-student, teacher-families and teacher-teaching team). As specific objectives, gender, teaching specialties, interaction between gender*teaching speciality, and significant predictors were analysed.

Design/methodology/approach – The research was quantitative, with a non-experimental, cross-sectional, descriptive and inferential design.

Findings – The results showed an explorer-expert teacher, where the generalist teachers had a superior competence compared to the rest of the specialties. Gender and teaching speciality were significant predictors in the communication that the teacher has with all the agents involved, while the interaction of both predictors was only significant between the teacher-teaching team and teacher-families.

Research limitations/implications – Another issue worth considering relates to the development of the classification tree for the use of digital resources in tutorial action. Due to lack of space, the proposal has focused on gender and particular subjects, but it would be interesting to focus on the dimensions of the instrument with regard to tutorial action with the different agents (students, teaching staff and families).

Originality/value – After reviewing the literature, the authors can conclude that very little quantitative research is focused on the level of self-perception of digital competence of teachers in rural schools. Furthermore, the teaching speciality of teachers has up until now hardly been taken into account as a variable

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that can determine the levels of digital competence. Not many studies have analysed the use of digital resources to communicate with the different members of the educational community.

Keywords Digital competence, Teachers, Rural education, Teaching speciality, Gender

Paper type Research paper

1. Introduction

Education, as a universal right, should transcend physical, social or cultural barriers (Eron, 2021). As stated by Romlah *et al.* (2021), there is a need to enhance the quality of resources to improve the educational process itself and to reduce geographical constraints in rural areas (Akifieva *et al.*, 2021). Indeed, the research highlights that rural teachers are leaving their posts owing to geographical remoteness and even low salaries (Biddle and Azano, 2016). From the point of view of students' educational background, the loss of well-qualified and trained rural teachers has become "*not just an educational issue, but also an equality issue*" (Behrstock-Sherratt, 2016, p. 13).

The digital gap has a profound effect on connectivity in any country, regardless of its developmental stage (Varela *et al.*, 2020). Moreover, the difference can be perceived even within the same country and even in the same geographical area. This digital gap has a deep impact on infrastructure, equipment and training (Buthelezi *et al.*, 2021). In turn, Information and Communication Technologies (ICT) can help reduce the education gap in rural contexts (Fernández-Morante *et al.*, 2022; Gnanamkonda *et al.*, 2019; Halili and Sulaiman, 2019) even in older people (Tomczyk *et al.*, 2023). The scientific literature has shed some light on this situation, describing the lack of facilities and educational resources in rural areas (Jerry and Yunus, 2021; Rana *et al.*, 2022; Rundel and Salemink, 2021). The lack of ongoing training for rural teachers was also highlighted (Hasin and Nasir, 2021; Madlela, 2022; Padilla *et al.*, 2021). If teachers are given further training in digital skills, they will be able to respond to a wider range of educational demands (Cabero-Almenara *et al.*, 2022; Pinto *et al.*, 2023). This would include technology-mediated mentoring processes.

Goodlad (2013) states that a teacher should provide support, advice and guidance to students, along with supervision and academic help throughout the school years (Hopper, 2001). During this time, the teacher has to work on developing the students' study skills, autonomous learning skills and personal and social responsibility (Levy-Feldman, 2018). With this approach, Martínez and Ortiz (2005, p. 129) argue that the tutoring process "*aims to prevent a range of different problems, both learning and personal, resolving the possible shortcomings or deficiencies that students present*". However, the teacher's remit also includes communication with the students' families, as well as coordination with the rest of the teachers who teach similar groups.

COVID-19 has given a major impetus to online teaching (Guillén-Gámez *et al.*, 2022; Eseadi, 2023; Oguguo *et al.*, 2023). This applies in particular to rural areas, often with poor transport links and being left out of the digital highway (Dube, 2020). Thus, a rural location on its own is already a drawback in teacher-student communication and the ability of students to get in touch with their families (Hansen-Thomas *et al.*, 2016; Xu and Raaper, 2022). In this context, Quinn *et al.* (2022) assert that the growth of platforms and digital resources we are experiencing at the moment can make the mentoring process more accessible to teachers. As Gordon (2003) highlights, today's teachers have more opportunities to mentor and guide students thanks to the increased use of ICT. In this context, positive experiences of the process of online tutorial action with the help of digital resources stand out (Vasquez and Slocum, 2012), as well as other studies focusing on rural schools (Ersin and Atay, 2021; Redmond, 2015).

In order to develop online mentoring processes to support communication and interaction with students, families and co-teachers, teaching staff need to have adequate digital skills (Seoane and Pefialvo, 2008). This will lead to more effective use of technologies in the teaching-learning process (O'Malley *et al.*, 2013) and, consequently, better mentoring of students through the wide range of possibilities offered by ICT (Pantoja *et al.*, 2020). Therefore, the main questions this study aims to answer are the following: Are rural teachers sufficiently trained in educational technology? Are there differences in the level of digital competence of teachers according to their teaching area or gender? What are the digital resources indicating the development of this competence?

2. Related work

In an international context, Zenda and Dlamini's (2022) study of 100 teachers in rural schools in South Africa found that the majority of teachers did not have a good level of digital competence, and lacked the ability to interact effectively with students, colleagues and families regarding the use of ICT tools. Similar results were found in Dahal's (2021) qualitative research in three rural schools in Nepal (India) through oral interviews with teachers and head teachers. In addition to lack of digital knowledge, other authors have also found a lack of technological resources and infrastructure (Moore, 2022). These findings are in line with one of the interviews conducted by Coker (2019, p. 10) in Scotland, stating that "*there's also a whole subset of skills that lots of teachers don't have … IT skills … as a profession they are not universally inculcated*". Thus, Esteban-Navarro *et al.* (2020) proposed a possible solution to this issue when analysing 28 documents on how to overcome the digital gap in the European education system in rural areas. The study suggested medium-term actions such as the evaluation of regional policies and training in advanced digital skills to improve social communication processes. On the contrary, the work of Stenman and Pettersson (2020) showed some contradictory results: Given a mixed approach involving ten rural teachers from Sweden, the teachers' digital skills were good; however, in virtual communication processes with students and other teachers, the results were not encouraging. Positive results regarding digital communication between teachers and families were corroborated by the studies by Kuusimäki *et al.* (2019, 2021). In summary, all these studies share a common factor: none of them have analysed the gender variable.

On a national level, Guillén-Gámez and Mayorga-Fernández (2022) measured the level of self-perception in digital competence of 847 rural teachers. The teachers' skills were satisfactory (mainly when communicating with other teaching staff), and to a lower degree regarding the interaction with students and their families, stating significant differences by gender in these last two aspects. Furthermore, the study by Raso *et al.* (2015), carried out in Granada (Spain), showed fewer positive results. The findings exposed that, although teachers have some technical competence, the use of ICT in teaching in many cases does not go beyond producing PowerPoint presentations. Along the same lines, the studies by Ruiz (2020) with a sample of 44 rural teachers from Albacete, and the study by del Moral *et al.* (2014), with a sample of 117 rural teachers from Asturias, showed that rural teachers made limited use of ICT, due to a lack of training in digital skills. None of these studies explored the gender variable.

Studies into the digital competence of teachers in rural schools have focused on the figure of the teacher in a generic way and paid little attention to the use of this competence for the development of tutorial action. No work was focused on the mentor and his or her speciality, this being one of the main contributions of this research. In this context, Siddiq *et al.* (2016) assessed the digital competence of 1072 Norwegian teachers through frequency of ICT use, ICT self-efficacy and perceived usefulness of ICT. They found no significant differences by gender, but did find differences between subject areas, where teachers of humanities, languages and arts were found to have better skills, followed by mathematics and science teachers. It should be noted that Physical Education teachers ranked amongst those with the lowest levels of training in digital competence. In contrast, in a meta-analysis of ICT use, Schmid *et al.* (2014) found that teachers of Science, Technology, Engineering and Mathematics subjects benefited more from the use of ICT than teachers of other subjects. With a sample of pre-service teachers from various Elementary Education majors ($n = 599$), Aslan and Zhu (2017) found significant differences in ICT integration, with science teachers scoring higher than teachers of social sciences or mathematics, the latter scoring the lowest. However, the gender variable showed no significant differences. In the Spanish context, Pozo *et al.* (2021) identified that generalist Primary School teachers did more ICT activities than specialist teachers, where the gender variable did not produce differences.

With regard to the use of digital applications to support tutorial action, few studies have addressed this aspect, and even fewer focused on a rural environment. Among the exceptions is a study by Guillén-Gámez and Mayorga-Fernández (2022) which was set in a rural context. The researchers found that the use of Twitter, blogs, ClassDojo and/or Moodle enhanced the digital competence level of rural teachers. Also of relevance is the work of Álvarez-Álvarez and García-Prieto (2021), whose analysis with 306 teachers from rural schools in Spain showed that they communicated with the educational community through blogs and WhatsApp, favouring the development of communication skills. Similar results were also evidenced with the use of blogs (García-Martín and Cantón-Mayo, 2019), WhatsApp (Nedungadi *et al.*, 2018; Wasserman and Zwebner, 2017) or Twitter (HiguerasRodríguez *et al.*, 2020).

After reviewing the literature, we can conclude that very little quantitative research is focused on the level of self-perception of digital competence of teachers in rural schools. Furthermore, the teaching speciality of teachers has up until now hardly been taken into account as a variable that can determine the levels of digital competence. Not many studies have analysed the use of digital resources to communicate with the different members of the educational community. Taking all this into account, the following general objective is set out in this research:

- *O1.* To ascertain the level of self-perception in digital competence of rural teachers. And as specific objectives of the study.
- *O2.* To ascertain whether the teaching speciality taught by the teacher has an impact on the level of self-perception in digital competence in the three processes of tutorial action (teacher-student, teacher-teaching team and teacher-families).
- *O3.* To ascertain if gender has an impact on the level of self-perception in digital competence in the three processes of the tutorial action.
- *O4.* To analyse the interaction between both factors (gender*teaching speciality) and to ascertain the level of self-perception in digital competence.
- *O5.* To predict the level of digital competence as a function of the relationship of different covariates (digital resources for communicating and interacting with the educational community).

3. Method

3.1 Design and participants

The research was quantitative, with a non-experimental, cross-sectional, descriptive and inferential design. The study was based on an incidental non-probabilistic sample of 847 active rural primary school teachers across Spain. However, a small part of the sample ($n = 30$) did not respond to the question as to what type of teaching speciality they carried out at the school and was therefore eliminated from the study. The final sample consisted of 817 teachers, 68.20% ($n = 557$) of whom were female, with a mean age of 41.10 $\pm$ 15.52; while 31.80% ($n = 260$) were male with a mean age of 43.24 $\pm$ 17.12. Categorised by teaching speciality, the distribution was: general education (54.2%), foreign languages (18.1%), special education (10.2%), physical education (13%) and music education (4.5%).

3.2 Instrument

In order to meet the objectives of the study, the questionnaire "Digital competences of Pre-school and Primary School teachers from the perspective of tutorial action", developed by

Rufete *et al.* (2020), was used. Unfortunately, this instrument lacked the psychometric properties required to be considered valid and reliable for measuring this competence. Thus, Guillén-Gámez *et al.* (2021) conducted a satisfactory model of the instrument in which all the psychometric properties necessary to ensure its validity and reliability were verified. The following dimensions were used for this study: DIM. 1 (Interaction of the teacher with the students), with a total of 9 items; DIM. 2 (Interactions of the teacher with the rest of the teaching staff teaching the class), with a total of 6 items and DIM. 3 (Roles of the teacher with the students' families), with a total of 8 items.

The validity of this study was tested through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). IBM SPSS V.24 software was used to carry out the EFA, while the AMOS V.24 software was used for the CFA. In the EFA, the method used for factor selection was the maximum likelihood method with oblique rotations. The obtained factors were orthogonally rotated using the Varimax method with Kaiser Normalisation. The Kaiser–Meyer–Olkin index was appropriate and significant (KM = 0.949) and the Bartlett's Chi-square test result was significant ($p<0.05$). The model explained 61.03% of the true variance of the teachers' scores. The coefficients found were satisfactory, respecting the thresholds established by Bentler (1989) and Schumacker (2004). Root mean square residual (RMR) values below 0.10 are considered favourable; a CMIN/DF ratio below 5 indicates a good fit; the Tucker–Lewis index (TLI), the comparative fit index (CFI), the Normed Fit Index (NFI) and the incremental fit index (IFI) consider values above 0.90 as a good fit. Root mean square error of approximation (RMSEA) values between 0.05 and 0.08 are adequate, composite reliability (CR) coefficients values above 0.70, average variance extracted (AVE) with values above 0.50 and maximum shared variance (MSV) with a value lower than the AVE coefficient are considered good. Table 1 shows the coefficients found for each index analysed for both the validity of the model and its reliability.

To measure the level of self-perception in digital competence, a 5-point Likert scale was used, where a value of 1 is associated with a very low and a value of 5 with a very high score. Thus, this scale can be interpreted using the recommendations of Padilla-Hernández *et al.* (2019): a teacher who is new to educational technology and needs more help with its application; an explorer teacher who has begun to experiment with digital resources but does not yet have strategies and needs to improve his or her skills; an integrator teacher who experiments with ICT resources according to the context; an expert teacher who already has some confidence in using digital resources in the tutorial action process, evaluating the use he or she makes of them with the aim of improving his or her educational practice; and a leader teacher who has a wide repertoire of flexible, complete and effective digital strategies and examples for other teachers.

	CMIN/DF	p	CFI	TLI	IFI	NFI	RMR	RMSEA
	3.551	0.001	0.923	0.914	0.923	0.901	0.056	0.068

Model Fit Summary.	Dimensions	DIM. 1	DIM. 2	DIM.3	TOTAL
Validity	CR	0.871	0.887	0.858	–
	AVE	0.567	0.585	0.551	–
	MSV	0.363	0.472	0.537	–
Reliability	Alpha	0.878	0.881	0.844	0.948
	Omega McDonald	0.929	0.944	0.906	0.995
	Spearman–Brown	0.860	0.861	0.843	0.893

Note(s): Table by authors

Table 1. Confirmatory factorial results and reliability of the instrument

3.3 Procedure and data analysis

(1) In order to verify the purpose nº 1, measures of central tendency (mean) and dispersion (standard deviation) have been used. This verification was made throughout Section 4.2 after applying the statistical techniques that appear in the following paragraph. In this way, the descriptive study is carried out in depth, for each gender and teaching speciality.

(2) To carry out objectives 2, 3 and 4, ANOVA (ANalysis Of VAriance) has been used, where comparisons have been carried out with the following nominal variables: gender (male-female) and teaching speciality (generalist, foreign language, special education, physical education and music education). The generalist teacher teaches mathematics, language, artistic, social and natural science. Although the data do not meet the assumption of normality, according to Srivastava (1959), non-normality would not have a serious effect on the distribution of data in large samples (in our case, $n = 817$). Furthermore, Mena *et al.* (2017) note that the ANOVA F-statistic is robust, in terms of Type I errors when distributions have skewness and kurtosis values ranging between -1 and 1. This was tested and this assumption was met for all items in the instrument. For those interactions that are significant, the effect size is calculated through partial eta squared (n^2), where $\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ indicates a medium effect; and $\eta^2 = 0.14$ indicates a large effect (Richardson, 2011).

For those interactions that are significant, t-Student will be applied. Specifically, the level of self-perception in digital competence will be compared between the types of teaching specialism and for each gender separately. Cohen (1988) interprets the magnitude of the effect size as such: a value less than 0.4 is a small effect, between 0.5 and 0.7 a medium effect, and more than 0.8 a large effect.

(3) Thirdly and finally, in order to identify the predictors (digital resources for communication) that are the most common for each type of teacher according to their teaching speciality, classification trees are the most suitable technique. This was applied with the Chi-square automatic interaction detection method to detect relationships between pairs of significant variables using the maximum likelihood technique.

4. Results

4.1 Comparative analysis of digital competence in teaching by gender and subject area

Regarding the level of self-perception of the teacher's digital competence to carry out the mentoring process with students (DIM. 1), the model is significant, $F(9, 807) = 42.224, p < 0.05$, with a large effect size ($n^2 = 0.320$). Specifically, the gender variable was significant, $F(1, 807) = 6.692$, $p < 0.05$, with a small effect size ($n^2 = 0.008$). The teaching speciality variable was also significant, $F(4, 807) = 89.880, p < 0.05$, with a large effect size ($n^2 = 0.308$). In contrast, the interaction between the two factors was not significant.

Regarding the level of self-perception of the teacher's digital competence to carry out the mentoring process with the rest of the teaching staff teaching the class group (DIM. 2), the model is significant, $F(9, 807) = 23.921, p < 0.05$, with a medium effect size ($n^2 = 0.211$). For this model, two of the three variables were significant: teaching speciality, $F(1, 807) = 39.301$, $p < 0.05$, with a large effect size ($n^2 = 0.163$); and the interaction between the two factors, gender*speciality, $F(1, 807) = 15.720, p < 0.05$, with a small effect size ($n^2 = 0.072$). In contrast, gender was not found to be significant.

Regarding the level of self-perception of the teacher's digital competence to carry out the mentoring process with the students' families (DIM. 3), the model is significant,

$F(9, 807) = 16.542$, $p < 0.05$, with a large effect size ($n^2 = 0.156$). For this model, all three sources have been significant: gender, $F(1, 807) = 15.950$, $p < 0.05$, with a very small effect size ($n^2 = 0.019$); teaching speciality, F $(1, 807) = 33.770$, $p < 0.05$, with a large effect size ($n^2 = 0.143$); and the interaction between the two factors, gender*speciality, $F(1, 807) = 3.638$, $p < 0.05$, with a small effect size ($n^2 = 0.018$).

As a result of these results, it has become clear that there are significant differences in the gender*speciality interaction in two dimensions (teacher-teaching staff and teacher-families). In this sense, we will now analyse this interaction in depth in order to find out which teaching particular subjects are significant predictors of gender.

4.2 Multiple comparisons between genders for each teaching speciality

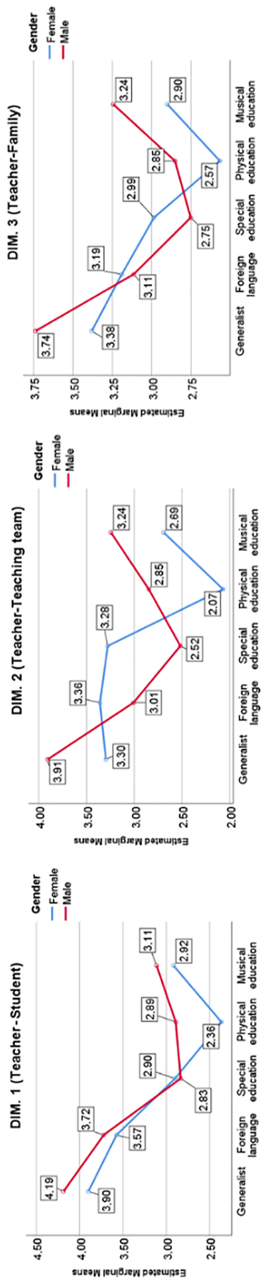
Figure 1 (DIM. 1) shows the competences of teachers to carry out the tutorial action process with their group class of students, showing a general level ranging from explorer to expert, for both genders. Specifically, it can be seen that it is the generalist teacher who has a more satisfactory competence. This was found to be slightly higher with male teachers (M = 4.19) compared to female teachers (M = 3.90). It is also observed that those who have a lower level are the physical education tutors, as in the male gender (2.89) as in the female gender (2.36). Regarding the multiple comparisons, although the interaction between gender*teaching speciality was not significant as mentioned in the previous section (since the analysis is at a global level with all particular subjects), it can be seen in Figure 1 that individually there are significant differences in some particular subjects, but not in all of them. Specifically, significant differences were found between the scores of male and female teachers in the following particular subjects: generalist ($t = 4.335$, d = 0.427) and physical education ($t = 2.273$, d = 0.444).

Figure 1 (DIM. 2) shows the teacher's competences for carrying out the tutorial action process with other educational staff teaching a particular class, showing a general level ranging from explorer to integrator, for both genders. Specifically, it is observed that male teachers achieve higher scores in all types of teaching than female teachers, except for foreign language and special education teachers. It is also evident that those teachers who have a higher level of competence are the generalist teachers, both for males (M = 3.91) and females (M = 3.30); while those who have a lower level of competence are the physical education teachers, for both genders (female = 2.07; male = 2.85). Statistically, significant differences were found between the genders of teachers in all particular subjects: general education ($t = 7.164$, d = 0.705), foreign language ($t = 1.986$, d = 0.19), special education ($t = 3.167$, d = 0.729), physical education ($t = 5.148$, d = 1.005) and music education ($t = 2.004$, d = 0.527).

Figure 1 (DIM. 3) shows the teacher's competences for carrying out the tutorial action process with the pupils' families, showing general levels similar to the previous dimension (DIM. 2), from the explorer teacher to the integrator teacher, for both genders. As in the previous dimension, a specific trend can be observed with regard to the comparison by gender. In all particular subjects, male teachers are more highly competent than female teachers, except in the speciality of foreign language and special education. It can also be seen that generalist teachers score higher, both for males (M = 3.74) and females (M = 3.38) compared to particular subject's specialist teachers. It is also evident that physical education teachers achieve a lower score, in both genders (female = 2.57, male = 2.85). Significant differences were found between the genders of the teachers only in the following particular subjects: generalist ($t = 4.928$, d = 0.485) and music education ($t = 1.984$; d = 0.182).

4.3 Results of classification techniques (trees) for each stage of education

With the findings made so far, significant differences were found in the level of self-perception of digital competence with respect to the teacher's gender and in respect of



Source(s): Figure by authors

Figure 1.
Teacher's digital competence to communicate with students, teaching staff and families

teaching specialisations. But in what order do these significant predictors affect the teacher's digital competence, and is there an interrelationship between predictors that indicate a higher digital competence? Classification trees are the ideal method to answer this question. Although the tutorial action process is carried out on three different levels, in this study, we will only develop the classification tree only by gender and particular subjects and not by dimensions of the instrument (students, teaching staff and families). This is further explained in the section on limitations. The covariates analysed in the segmentation trees all follow the same dynamic with respect to the following question: As a teacher, have you previously used the following digital resources to carry out the tutorial action process? These digital resources were: blogs, Instagram, WhatsApp, TikTok, Facebook, Twitter, Google+, ClassDojo and Moodle modules.

Figure 2 shows the classification tree for female teachers, where two levels of digital competence have been combined (node 0, $M = 3.26 \pm 0.72$). It is observed how the tree has agglutinated several specialties in a single branch, this is due to the fact that the digital resources that significantly influence are the same for the agglutinated specialties. For generalist and foreign language teachers, the level of digital competence is between integrative and expert. It can be observed that the use of Twitter in the tutorial action process helps considerably to increase this competence (node 5, $M = 3.95 \pm 0.42$). Moreover, if the teacher uses ClassDojo in addition to Twitter, his or her digital competence increases slightly (node 11, $M = 4.05 \pm 0.29$). For teachers focused on special education and music teaching, their competence level is between explorer and integrator. If teachers use blogs in the educational process, their competence level could increase to an integrative level (node 7, $M = 3.06 \pm 0.69$). For teachers specialising in physical education, it is observed that their level is that of explorer tutor (node 3, $M = 2.33 \pm 0.69$). For this group, no digital resource is associated as an incident factor due to the lack of sample size, which will be discussed in the limitations of the study.

Figure 3 shows the classification tree for male teachers, where the level of digital competence falls between integrator and expert (node 0, $M = 3.59 \pm 0.74$). It can be seen that the highest level of competence was achieved by the generalist teacher with an expert level (node 1, $M = 4.11 \pm 0.53$). For this group, the use of WhatsApp in the guidance process causes the competence level to increase slightly (node 5, $M = 4.31 \pm 0.54$), although if the group also use blogs, this increases considerably (node 11, $M = 4.43 \pm 0.52$). For foreign language, special education and music education teachers, the use of Moodle slightly increases the competence level (node 7, $M = 3.58 \pm 0.77$). For physical education teachers, the level is close to integrative (node 3, $M = 2.86 \pm 0.80$). For this group, the use of blogs in the tutorial action process with students, teaching staff or families makes their competence level increase slightly (node 9, $M = 3.12 \pm 0.93$).

5. Discussions and conclusions

Digital competence for teachers is increasingly relevant in today's society. The way teachers interact with their students, with other teachers who teach the same group and with the students' families, all of this can benefit from the use of digital applications, even more so in rural contexts, where the existing digital divide needs to be overcome (Esteban-Navarro, 2020), and consequently be able to offer students an equitable education with well-qualified teachers (Behrstock-Sherratt, 2016).

Firstly, rural teachers have a digital competence for communication with different agents that varies between explorer and expert level (O1). This range shows that in rural schools there are, on the one hand, teachers who do not yet have a good level of digital competence, coinciding with the findings of Ruiz (2020) and Zenda and Dlamini (2022); and on the other hand, teachers who have adequate digital skills, corroborating the findings of Guillén-Gámez

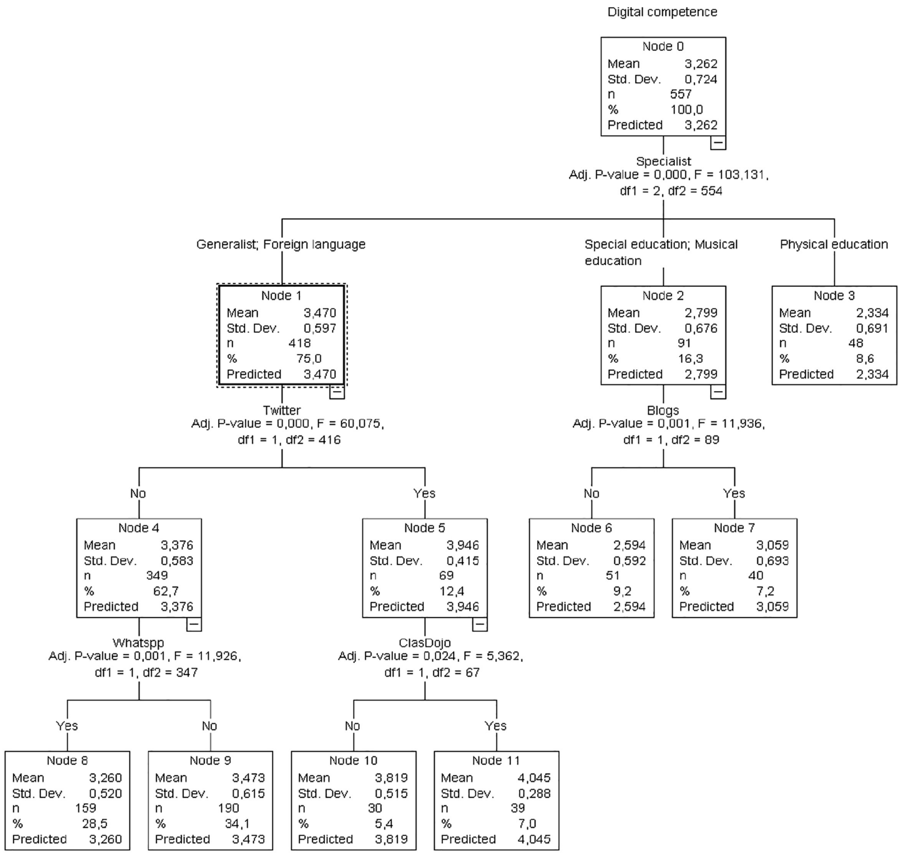
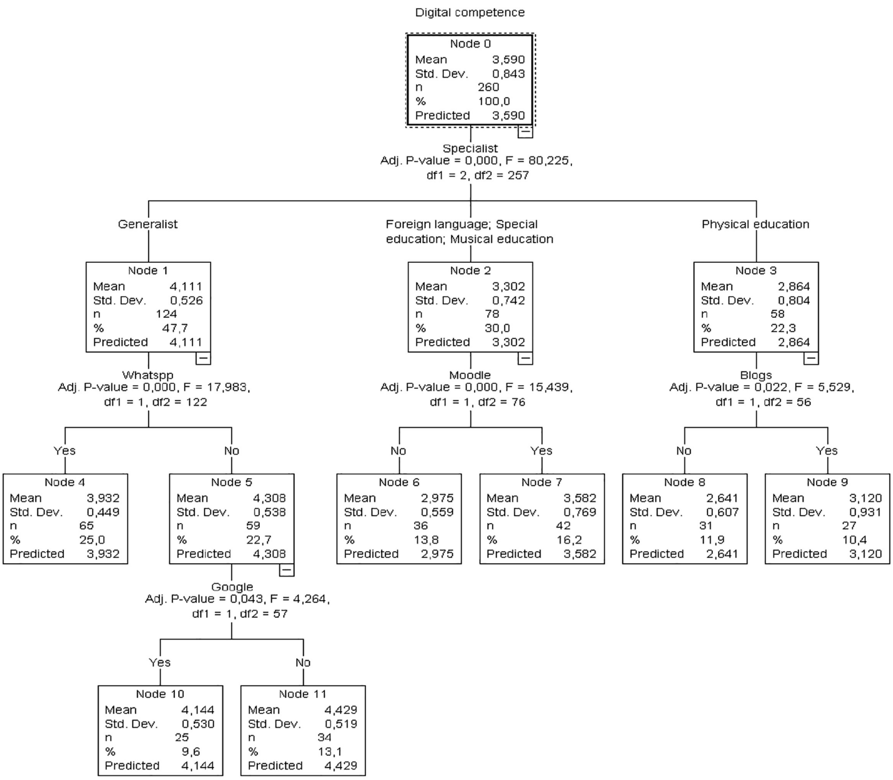


Figure 2.
Segmentation tree for the female guardian

Source(s): Figure by authors

and Mayorga-Fernández (2022), Kuusimäki *et al.* (2019, 2021) and in part the results of the study by Stenman and Pettersson (2020) as these authors pointed out that teachers' specific skills in digital communication with students and teaching staff were not satisfactory. A plausible explanation for the results of this study may be the state of technological infrastructures and the scarcity of digital resources in rural schools (Jerry and Yunus, 2021; Rana *et al.*, 2022; Rundel and Salemink, 2021). This caused teachers to be less familiar with the use of ICT where some other studies have shown a positive relationship between the higher use of ICT and the acquisition of digital skills (Lucas *et al.*, 2021; Ghomi and Redecker, 2019). Moreover, this study was conducted during COVID times when the educational process was virtually online. So, another possible answer as put forward by the World Bank (2020) is that very few teachers had yet received adequate training in their own particular learning environment and had not mastered the digital tools to teach online in this complicated and complex year.

Secondly, the teaching specialism itself has a significant impact on self-perceived levels of digital competence for mentoring processes (O2). Thus, generalist teachers are those who have a more adequate competence almost at expert level, both in terms of interaction with students, teaching staff and students' families. A competence close to that of an expert



Source(s): Figure by authors

Figure 3. Segmentation tree for the male guardian

teacher, according to Padilla-Hernández *et al.* (2019), would have a wide repertoire of effective digital strategies, even for teaching teachers of other particular subjects, mainly physical education teachers, who have been found to have a low to satisfactory competence. These results are corroborated both in the study by Pozo *et al.* (2021), which shows that generalist teachers have better skills in communication processes because they are more likely to use ICT, and in the study by Siddiq *et al.* (2016), where physical education specialists had low digital training. One possible explanation for the results in PE is that many teachers may think that the use of ICT goes against the very philosophy of the subject itself, which focuses on physical activity and the development of motor skills and abilities. However, as stated by O'Malley *et al.* (2013), an effective use of ICT has an impact on the educational process and, consequently, the mentorship and guidance of students could be improved (Pantoja *et al.*, 2020). Hence, the use of digital resources such as sports simulators or applications to assess physical fitness could be good options for the development of fitness and physical education skills.

Thirdly, some of this study has shown that there are significant differences in the self-perceived level of digital competence between the genders of rural teachers (O3). It is found that male teachers are better digitally trained than female teachers in the mentoring process carried out by teachers with students and families, coinciding with the findings of the study by Guillén-Gámez and Mayorga-Fernández (2022), finding no differences for the process between teachers and teaching staff, corroborating the results of Siddiq *et al.* (2016), Aslan and Zhu (2017) and Pozo *et al.* (2021). Perhaps a plausible explanation for digital learning between teachers and colleagues is that both types of teachers work collaboratively on a daily basis, so that communication and development are bidirectional. However, these results should be interpreted with caution, as this predictor will be analysed in greater depth in the next objective of the study.

Fourth (O4), while the gender*tutor-pupil interaction was not significant, the gender*mentor teaching team interaction was significant, with differences in all teaching specialisations with higher scores for male and generalist teachers, as was the gender*tutor-family interaction, with significant differences between male music education and generalist teachers, with more digital training for the latter. These findings coincide to some extent with the study by Pozo *et al.* (2021), where generalist teachers are the ones who did more activities through ICT, although the gender variable was not significant, as well as with Schmid *et al.* (2014), where generalist teachers were also better digitally trained than other teachers in areas such as arts, humanities and social sciences. One possible answer to the results for generalist teachers (language, mathematics, social sciences, natural sciences and arts) may be that there is a wider range of digital resources in these subjects than in other areas such as, for example, special education or physical education. With respect to teachers in other subject areas, the differences may be due to their beliefs about the usefulness of ICT for teaching specific subjects (Teo, 2014).

Finally (O5), female teachers, specifically generalist and foreign language teachers using Twitter, increased their competence level, a fact that was already reflected in the work of Higueras-Rodríguez *et al.* (2020). Moreover, if they also use ClassDojo for guidance, their level of digital competence increases slightly, coinciding with the work of Guillén-Gámez and Mayorga Fernández (2022). On the other hand, the use of the blog in the mentoring process improves the level of competence for music and special education teachers. This is due to the communicative potential of blogs, a fact confirmed in the work of Álvarez-Álvarez and García-Prieto (2021). As for male teachers, the orientation process via WhatsApp improves generalist teachers' perception of their digital competence. These results are similar to the findings of other studies (Álvarez-Álvarez and García-Prieto, 2021; Nedungadi *et al.*, 2018; Wasserman and Zwebner, 2017), where the WhatsApp digital application had a positive impact as a communication channel. For PE teachers, the use of blogs increased their level of digital competence, confirming their communicative usefulness as occurred in the study by García-Martín and Cantón-Mayo (2019). On the other hand, the use of Moodle has a positive impact on digital competence for special education, foreign language and music teachers, coinciding with the findings of Guillén-Gámez and Mayorga-Fernández (2022), where Moodle also improved the perception of digital competence of rural teachers.

In terms of the limitations of this study, it is worth noting the sample size for some particular subjects, where the number of participants was not sufficient to allow an analysis as to the use of any digital resource for the tutorial action process has a significant impact on self-perceptions of the level of digital competence. Another issue worth considering relates to the development of the classification tree for the use of digital resources in tutorial action. Due to lack of space, the proposal has focused on gender and particular subjects, but it would be interesting to focus on the dimensions of the instrument with regard to tutorial action with the different agents (students, teaching staff and families).

With regard to future work, analysing the tutorial action processes in teachers at other educational stages such as secondary school could be revealing both in terms of the type of ICT they use and the way in which the tutorial action process is organised and developed. Another interesting study would focus on analysing the digital resources used in terms of the mentoring process carried out by teachers with families, teaching staff and pupils. This is due to the fact that this study has been analysed in a general way, without examining it for each topic, so perhaps any digital resources found to have been significant may be different depending on the type of interaction.

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About the authors

Dr Francisco David Guillén-Gámez is Assistant Professor Doctor of the Department of Didactics and School Organization, Faculty of Educational Sciences at the University of Malaga and member of the Educational Innovation and Technology Research Group -INNOEDUCA- at the University of Malaga (SEJ-533). His research interests are in educational technology, teaching digital literacy and research designs with quantitative approaches. He is the author of more than 20 articles ranked in SJR Q1 impact journals, with at least six of them also ranked as JCR Q1. He is deputy director of the scientific journal INNOEDUCA. Francisco David Guillén-Gámez is the corresponding author and can be contacted at: davidguillen@uma.es

Ernesto Colomo-Magaña is Doctor in Education Sciences, and has an official master's degree in social change and educational professions and a degree in pedagogy at the University of Malaga. He is Professor of Theory and History of Education at the University of Malaga, and a member of the InnoEduca Research Group (SEJ-533). His research interest concerns educative technology, active methodologies, digital competence, ICT resources and axiology.

Julio Ruiz-Palmero has a Ph.D. in Educational Technology from the University of Malaga (Extraordinary Award), a master's degree in New Technologies Applied to Education, a University Expert in Virtual Training Environments and a bachelor's degree in Mathematics. He developed his teaching work as Full Professor at the University of Malaga in the Department of Didactics and School Organization. He has recognised two stretches of research and seven three-year teaching periods. He is the editor of the Innoeduca Journal (International Journal of Technology and Educational Innovation), and has directed the Innoeduca Research Group – SEJ-533 – of the University of Malaga for years, with the commitment to investigate teaching-learning processes with technology.

Łukasz Tomczyk, Ph.D., is a postdoc fellow at the Italian University of Macerata. His research interest concerns media education, information society and lifelong learning. He conducts academic classes and trainings on digital safety, prevention of risky behaviours on the Internet, adult education and ICT use. He is the author of 7 monographs and 180 scientific articles and editor of 13 collective monographs. He is Associate Editor in "Education and Information Technologies" journal (Springer). He is a scholarship holder of the Polish Ministry of Science and Higher Education (outstanding young scientists 2018–2020). He is a member of the research networks: EU KIDS Online and COST Action CA16207 European Network for Problematic Usage of the Internet.