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Factors Influencing the Development of Digital Competence in Teachers: Analysis of the Teaching Staff of Permanent Education Centres

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ABSTRACT The technological development of recent decades has had an impact on the lifestyle of adults. As a result, it has been necessary for citizens to adapt and learn how to use technological resources, an essential requirement to foster employability. This requirement acquires a special nuance within Permanent Education, which mainly involves adults who would like to cover some training need. The aims of this study were to analyze the digital competence of Permanent Education teachers, and to determine the factors that have an impact on its development. Therefore, a quantitative methodology has been used, whereby a sample of Permanent Education teachers in the region of Andalusia, Spain, were asked to complete a questionnaire on digital competence ($n = 140$). The results confirmed the low digital competence of teachers, and how some factors such as age, kind of centre, prior training on ICT, degree, teaching experience and professional category affect the development of digital competence. The last part of the study discussed the potential explanations for the study findings and suggestions for future research.

INDEX TERMS Digital competence, adult learning, information literacy, teacher professional development, 21st century abilities.

I. INTRODUCTION

The Digital Agenda for Europe 2020 passed by the European Parliament enshrines as a principle to ensure the digital skills and literacy of all citizens [1]. The G20 and the OECD advise of the need to train adults on the digital field to guarantee adequate work performance in current and future professions [2]. This need is extended to the teaching field, where the implementation of technology demands digitally-skilled teachers [3], [4].

In terms of education, different editions of the Horizon reports have set the trends regarding the adoption of Information and Communication Technologies (ICT) in higher education. Nevertheless, in the 2018 edition, they highlight the improvement of digital literacy as a significant challenge [5]. As a consequence, it is necessary to establish what the general action lines towards digitalization and digital competence development are [6], [7].

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Faced with this challenge, the adult population feels at a clear disadvantage compared to people who were born during the technology boom [8]. In this sense, adults have needed to start a learning process for the Internet and the handling of electronic devices. Nonetheless, the socio-economic context has influenced the progress of digital literacy in certain regions [9].

Andalusia, in Spain, is the region with the highest population in the country, and at the same time it has the highest rate of illiterate inhabitants. This has resulted in the presence of more than 600 public Adult Education centres in Andalusia. Taking this into account, this study focuses on the teaching staff of Centres and Sections of Adult Permanent Education (CEPER and SEPER). These teachers are responsible for training the adults who wish to meet a given training need, against the backdrop of the 21st century society, where digital competence is essential [10]. On this basis, the study intended to analyze teachers' digital competence and the socio-demographic factors that affect its development.

II. BACKGROUND

There has been a lack of consensus on the definition of the term "digital competence". In order to unify the concept, the revision of the literature on the definition of digital competence by Ilomäki *et al.* [11] highlights that digital competence comprises: (i) technical skills; (ii) the ability to use digital technologies meaningfully for work, studies and daily life; (iii) the ability to critically assess digital technologies; and (iv) the motivation to participate and to commit to digital culture.

In light of this phenomenon, several institutions have established general frameworks to specify the composition of digital competence and how it is measured, and to promote its development. Among the most relevant standards in the international and national context, we find the ICT Competency Standards for Teachers [12], the ICT National Educational Technology Standards for Teachers in the USA [13], the European Framework for the Digital Competence of Educators - DigComp [14] and the Common Framework of Digital Competence for Teachers in Spain [15].

Each framework has its own characteristics and they show different measurement units to catalogue the level of digital competence acquisition. However, they all include similar phases and contents. In sequence, UNESCO [12] describes three levels: (i) integration, in which ICT are used to inform and optimize communication channels; (ii) re-orientation, in which ICT are used as tools for enabling knowledge build-up; and (iii) evolution, in which ICT make it possible to create environments for representing, processing, transmitting and sharing information. ISTE [13] sets out four phases: (i) beginner, starting in the use of ICT; (ii) medium, with more experience and flexibility in the use of ICT; (iii) expert, with an efficient utilization of ICT; and (iv) transformer, adapting and applying ICT to change the teaching-learning process. The DigComp shows levels of classification similar to the ones established by the Common European Framework of Reference for Languages [16], being the framework with the highest level of concretion: A1 (newcomer); A2 (explorer); B1 (integrator); B2 (expert); C1 (leader); C2 (pioneer). Meanwhile, the Common Framework of Digital Competence for Teachers, which is a benchmark in Spain, is an adaptation of the European Framework DigComp. Nevertheless, it shows different levels of classification (basic, intermediate and advanced) based on the level of acquisition gained in each area of digital competence [15].

The INTEF [15] established five areas of reference that comprise digital competence in teachers:

1. Information and data literacy: ability to search, store, organise and analyse the relevant data available on the Internet.
2. Communication and collaboration: ability to interact through social media, to communicate and to share information.
3. Digital content creation: ability to prepare and edit digital content, either to generate new content or to rework existing content, taking into account intellectual property and copyright matters.
4. Security: ability to apply security measures to protect personal data and digital identity.
5. Problem solving: ability to solve problems in a creative way using technology and making the most appropriate decisions.

The level of acquisition in each area, particularly elementary levels (areas 1 and 2), has a direct impact on teaching activity and on the practical use of ICT [17]–[19]. In particular, older teachers have the added difficulty of lacking technological skills [20], in addition to the limited social and institutional systems, which hinder older adults' ability to acquire experience and ease with technology [21]. Therefore, there is a tendency for digital competence to be lower in the adult population than in youngsters [22], [23].

All the same, such digital skills cannot be learned by themselves, but need specific training [24]–[26]. This training is very frequently non-existent or does not have the desired effect of increasing users' levels of digital competence acquisition [27], [28]. Likewise, this problem does not only arise from the lack of specific training; social characteristics also influence digital competence development [29], [30].

In this regard, previous studies have manifested the influence of demographic factors on digital literacy levels in adults in Andalusia [9]: the influence of the years of teaching experience, the regular use of ICT, and the fact of seeing oneself as trained in the field of digital competence [31]; the links between age, occupation, the use of technology and its repercussion on digital competence [32]; the influence of gender, self-efficacy and socioeconomic background on the use of ICT [33]; and motivation itself and emotional variables as mediators in the effects of digital self-efficacy [34].

More specifically, the theoretical and empirical insights on adults' digital competence note that it is a topic of particular interest considering the specificities of this population sector. Nonetheless, most research works on digital competence focus on Secondary Education students [35], which shows a scarcity of research where the main aim of the study is Permanent Education. The aims of this study were: (i) to analyse the digital competence level of Permanent Education teachers; and (ii) to determine the factors that have an impact on digital competence development. At the same time, the following research questions were laid out:

RQ1 What is the digital competence level of Permanent Education teachers in Andalusia?

RQ2 Does the kind of Permanent Education centre have an impact on permanent education teachers' digital competence?

RQ3 Does the age factor have an impact on permanent education teachers' digital competence?

RQ4 Does gender have an impact on permanent education teachers' digital competence?

RQ5 Do qualifications have an impact on permanent education teachers' digital competence?

RQ6 Do years of teaching experience have an impact on permanent education teachers' digital competence?

RQ7 Does the professional category have an impact on permanent education teachers' digital competence?

III. METHOD

A quantitative methodology was used with the aim of collecting empirically verifiable data and describing the reality observed [36]. From a methodological perspective, this study has promoted the quantification of participants' answers, the establishment of statistical descriptive values and multiple linear regression models.

A. PARTICIPANTS

The population consisted of Permanent Education teachers in the region of Andalusia, Spain ($N = 2034$). The study applied a stratified random sampling, taking into account some provinces of Andalusia (Almeria, Cadiz, Cordoba, Granada, Huelva and Seville) and the three main typologies of Adult Education centres: Permanent Education Centres and Permanent Education Sections (CEPER and SEPER) and Secondary Education Schools with training for adults (IES). Thus, the sample consisted of 140 teachers, being a representative sample of the population with a 95% confidence index and a margin of error of 8% [37]. Access to this body of teachers is made through a public competition, which is divided into two main phases: (i) the competition stage, where the academic and professional merits of the entrant are taken into account and (ii) the public examination stage, where the entrant is faced with a written test and an oral presentation. Before applying to the body of teachers, it is necessary to be in possession of the official Master's degree in Teacher Training. Once selected, the teacher decides the type of school in which he or she would like to practice his or her profession. Although access to the body is the same for a secondary and a permanent education teacher, the difference lies in the type of student in each modality. In secondary education the age of the students is 12-18 years and in permanent education they are older than 18 years.

Table 1 shows the socio-demographic data. The age of the participants ranged from 22 to 55 years ($M = 35.4$, $SD = 8.56$) and the teaching experience was minimum 1 year and maximum 12 years ($M = 4.98$, $SD = 3.06$).

B. DATA COLLECTION

The data collection took place between January and March 2019 after implementing an online questionnaire on digital competence. The *ad hoc* questionnaire consisted of 91 items divided into the five areas of digital competence set by INTEF [15]. The items were based on each of the indicators included in each of the five areas: 16 indicators on information and data literacy; 31 on communication and collaboration; 16 on digital content creation; 13 on security; and 15 on problem solving. Participants were asked to indicate whether they have complied with each indicator, which can be consulted in open access in the INTEF document [15].

TABLE 1. Socio-demographic data.

	n	%
Region		
Almeria	28	20
Cadiz	16	11.43
Cordoba	17	12.15
Granada	49	35
Huelva	15	10.71
Seville	15	10.71
Centre		
CEPER and SEPER	97	69.28
IES	43	30.72
Gender		
Male	66	47.14
Female	74	52.86
Previous ICT training		
Yes	100	71.42
No	40	28.58
Degree		
Bachelor's Degree (before the Bologna Plan)	83	59.28
University Degree (after the Bologna Plan)	41	29.29
Master's Degree (postgraduate studies)	16	11.43
Professional category		
Public servant	88	62.85
Temporary	52	37.15

The response mode was categorized in a 10 point Likert scale (1 = never; 10 = always). The instrument reliability analysis gave an acceptable value in the Cronbach's alpha coefficient ($\alpha = 0.93$).

C. DATA ANALYSIS

For the analysis of data, the IBM software for quantitative analysis SPSS version 24.0 and RStudio version 1.1.383 were used. Firstly, the descriptive-statistical data were processed with the IBM programme SPSS, with the aim of calculating the mean and the typical deviation in each area. Subsequently, using RStudio, the Shapiro-Wilk test was used to calculate the multivariate normality of data, the Box's M test was used for the homogeneity of variances and covariances, and the GGally package function ggpairs for linearity. These steps were primordial to set the multiple linear regression models [38]. The confidence level used was 95% (p-value < 0.05).

The socio-demographic data and the areas of digital competence were codified with RStudio with the following abbreviations: CEPER and SEPER (Centre1); IES (Centre 2); Age (Age); Gender (Gender1); Previous ICT training (TIC.For1); Bachelor's and University Degree (Degree1); Master's Degree (Degree2); Teaching experience (Experience 2-12, from 2 to 12 years); Professional category (Prof.Cat1); Information and data literacy (B.1); Communication and collaboration (B.2); Digital contents creation (B.3); Security (B.4); and Problem solving (B.5).

IV. RESULT

In the first instance, the descriptive-statistical data of the five areas of digital competence were calculated to verify teachers' acquisition level. The collected answers, based on the Likert scale (1-10 points), showed a low level of digital competence, given that all the areas registered values lower than the neutral value (5) (table 2).

TABLE 2. Descriptive statistics.

Area	*M*	SD
Information and data literacy	3.239	1.616
Communication and collaboration	3.185	1.466
Digital contents creation	1.843	0.966
Security	3.954	1.103
Problem solving	3.695	1.096

In addition, in order to verify the adequacy of the multiple linear regression models, data were segmented in a training group and a testing group (p-value = 0.5), and the classical multivariate assumptions of normality, homoscedasticity and linearity were also calculated. The measures evidenced that the multivariate assumption normality (p-value >0.05) was not met. However, the assumption homogeneity of variance-covariance (p-value >0.5) was fulfilled. To this regard, no linearity issues were observed within the data (figure 1). Hence, multiple linear regression models would be appropriate.

More specifically, the multiple linear regression models explain the significance of the different socio-demographic factors with the areas of digital competence. The variables marked with an asterisk (*) contributed significantly in each area.

The linear regression model for information and data literacy (B.1) has a good adjustment, the model is significant (F-statistic (22, 26) = 2.655; p-value = 0.0092) and explains the 43% of the total variance of data (R^2 = 0.4314). The base category was Centre0, Gender0, Tic.For0, Experience1,

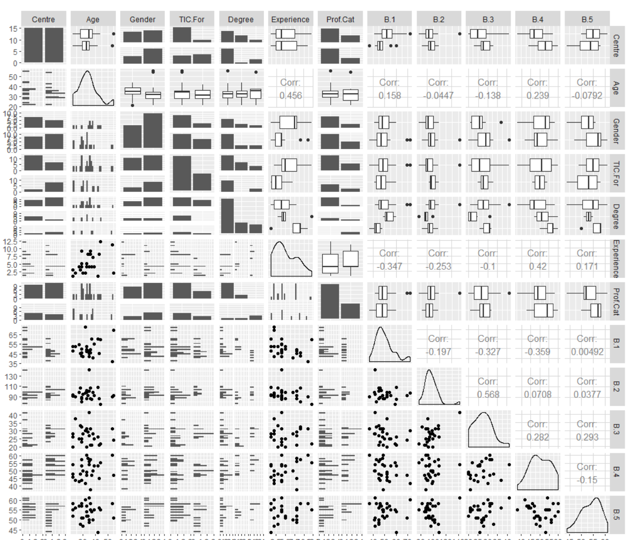

FIGURE 1. Linear and correlation analysis.

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    78.4882    27.7463   2.829  0.00888 **
Centre1        -0.7490     3.6345  -0.206  0.83833
Centre2         0.7359     3.9953   0.184  0.85529
Age             0.6655     0.2199   3.027  0.00551 **
Gender1        -1.9491     2.9178  -0.668  0.51002
TIC.For1       -4.1172     3.6023  -1.143  0.26348
Degree1        -2.4902     3.6486  -0.683  0.50096
Degree2        -7.8458     7.4183  -1.058  0.29995
Experience2   -10.6671     5.6005  -1.905  0.06794 .
Experience3    -3.1018     7.2938  -0.425  0.67414
Experience4   -10.8301     5.4984  -1.970  0.05962 .
Experience5    -7.7510     6.7440  -1.149  0.26089
Experience6   -29.4336     9.8920  -2.976  0.00625 **
Experience7   -10.5838     7.1212  -1.486  0.14924
Experience8   -19.3504     6.4260  -3.011  0.00573 **
Experience9    -9.5340     9.4086  -1.013  0.32024
Experience11  -27.3538    12.2126  -2.240  0.03387 *
Experience12   -8.7731     6.9063  -1.270  0.21523
Prof.Cat1      -0.9189     3.2219  -0.285  0.77774
B.2            -0.2651     0.1231  -2.153  0.04080 *
B.3             0.1785     0.1759   1.015  0.31942
B.4            -0.3081     0.2495  -1.235  0.22783
B.5             0.3179     0.3323   0.957  0.34757
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.72 on 26 degrees of freedom
Multiple R-squared:  0.692,     Adjusted R-squared:  0.4314
F-statistic: 2.655 on 22 and 26 DF,  p-value: 0.009217
```

FIGURE 2. Multiple linear regression model for B.1.

Prof.Cat0 and B1. For B.1, the significant socio-demographic factors are age and teaching experience of six, eight and 11 years. B.1 punctuations are significantly different compared to B.2 (figure 2).

The linear regression model for communication and collaboration (B.2) was not significant (F-statistic (22, 26) = 1.793; p-value = 0.077) and only explained 26% of the total variance of data (R^2 = 0.266). The sole variables that contribute significantly to B.2 were teaching experience of six years and B.1 (figure 3).

For the digital content creation area (B.3) the model was not significant either (F-statistic (22, 26) = 1.451;

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   108.4314    41.4110   2.618  0.01454 *
Centre1        -6.4040     5.1867  -1.235  0.22799
Centre2         2.7424     5.8407   0.470  0.64260
Age             0.4354     0.3653   1.192  0.24407
Gender1         0.6768     4.3153   0.157  0.87658
TIC.For1       -1.4320     5.4089  -0.265  0.79330
Degree1        -7.1649     5.2147  -1.374  0.18118
Degree2        -0.6727    11.1145  -0.061  0.95220
Experience2   -11.0288     8.5002  -1.297  0.20586
Experience3     1.7896    10.7323   0.167  0.86886
Experience4    -5.7138     8.5749  -0.666  0.51106
Experience5    -9.0315     9.9866  -0.904  0.37411
Experience6   -45.2828    14.2644  -3.175  0.00384 **
Experience7   -14.9655    10.4792  -1.428  0.16516
Experience8   -15.3220    10.5285  -1.455  0.15756
Experience9   -15.1197    13.7575  -1.099  0.28184
Experience11  -27.3457    18.8205  -1.453  0.15820
Experience12  -17.8478     9.8380  -1.814  0.08121 .
Prof.Cat1      -4.5906     4.6480  -0.988  0.33243
B.1            -0.5706     0.2651  -2.153  0.04080 *
B.3             0.4436     0.2483   1.787  0.08568 .
B.4             0.1348     0.3757   0.359  0.72266
B.5             0.1678     0.4949   0.339  0.73733
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 9.859 on 26 degrees of freedom
Multiple R-squared:  0.6027,    Adjusted R-squared:  0.2666
F-statistic: 1.793 on 22 and 26 DF,  p-value: 0.07731
```

FIGURE 3. Multiple linear regression model for B.2.

p-value = 0.1807), and gathered 17% of the total variance explained ($R^2 = 0.1713$). None of the variables contributed significantly to B.3. (figure 4).

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -36.25325   33.96530  -1.067   0.2956
Centre1       3.93243    3.90266   1.008   0.3229
Centre2       4.97386    4.26207   1.167   0.2538
Age          -0.17487    0.27752  -0.630   0.5341
Gender1      -1.55768    3.20379  -0.486   0.6309
TIC.For1      1.63098    4.02474   0.405   0.6886
Degree1      -1.52507    4.01479  -0.380   0.7071
Degree2      -0.51570    8.28511  -0.062   0.9508
Experience2   6.59988    6.40889   1.030   0.3126
Experience3   6.89598    7.88943   0.874   0.3901
Experience4   4.24881    6.39232   0.665   0.5121
Experience5   3.67886    7.52607   0.489   0.6291
Experience6   7.43873   12.44031   0.598   0.5550
Experience7   5.82634    8.03131   0.725   0.4747
Experience8   4.12439    8.12158   0.508   0.6159
Experience9   8.69382   10.35140   0.840   0.4086
Experience11 11.56436   14.41062   0.802   0.4295
Experience12  9.45992    7.55962   1.251   0.2219
Prof.Cat1     1.71441    3.51312   0.488   0.6296
B.1           0.21353    0.21035   1.015   0.3194
B.2           0.24649    0.13797   1.787   0.0857 .
B.4           0.01621    0.28072   0.058   0.9544
B.5           0.43120    0.35993   1.198   0.2417
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 7.349 on 26 degrees of freedom
Multiple R-squared:  0.5511,	Adjusted R-squared:  0.1713
F-statistic: 1.451 on 22 and 26 DF,  p-value: 0.1807
```

FIGURE 4. Multiple linear regression model for B.3.

Unlike the models of B.2 and B.3, the linear regression model of the security area (B.4) is significant (F-statistic (22, 26) = 2.209, p-value = 0.027). This model gathers 35% of the total variance of data ($R^2 = 0.356$). The base category was Centre0, Gender0, Tic.For0, Experience1, Prof.Cat0 and B.4. Concerning the statistical significance, we can highlight the kind of centre and the teaching experience of three years (figure 5).

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  81.606360  18.207158   4.482 0.000132 ***
Centre1       5.277546   2.579052   2.046 0.050962 .
Centre2       8.264527   2.588797   3.192 0.003671 **
Age           0.157836   0.192869   0.818 0.420591
Gender1       0.707202   2.243928   0.315 0.755154
TIC.For1     -4.660817   2.668188  -1.747 0.092475 .
Degree1       3.981608   2.701790   1.474 0.152570
Degree2       1.706799   5.778442   0.295 0.770055
Experience2  -5.389611   4.443439  -1.213 0.236060
Experience3 -12.897910   4.986839  -2.586 0.015651 *
Experience4  -4.579890   4.412754  -1.038 0.308885
Experience5  -5.232636   5.180903  -1.010 0.321810
Experience6  -1.922089   8.741803  -0.220 0.827687
Experience7  -0.194756   5.666772  -0.034 0.972846
Experience8  -6.194170   5.570613  -1.112 0.276342
Experience9   1.968619   7.318393   0.269 0.790056
Experience11 -1.394313  10.187008  -0.137 0.892187
Experience12 -3.710771   5.388680  -0.689 0.497159
Prof.Cat1    -1.478605   2.448250  -0.604 0.551115
B.1          -0.179858   0.145619  -1.235 0.227827
B.2           0.036549   0.101873   0.359 0.722665
B.3           0.007908   0.136991   0.058 0.954407
B.5          -0.467748   0.241442  -1.937 0.063642 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.134 on 26 degrees of freedom
Multiple R-squared:  0.6515,	Adjusted R-squared:  0.3566
F-statistic: 2.209 on 22 and 26 DF,  p-value: 0.02726
```

FIGURE 5. Multiple linear regression model for B.4.

Finally, the area of problem solving (B.5) has a significant model (F-statistic (22, 26) = 2.096; p-value = 0.036) and explains 33% of the total variance of data ($R^2 = 0.334$). The base category was Centre0, Gender0, Tic.For0, Experience1, Prof.Cat0 and B5. The results show that none of the variables contributed significantly to B.5 (figure 6).

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  56.96665   14.62845   3.894 0.000616 ***
Centre1      -0.64886    2.10628  -0.308 0.760490
Centre2       4.07724    2.17698   1.873 0.072370 .
Age          -0.21818    0.14202  -1.536 0.136537
Gender1      -0.01866    1.70709  -0.011 0.991362
TIC.For1     -1.53833    2.12022  -0.726 0.474593
Degree1       0.32577    2.13451   0.153 0.879874
Degree2      -0.68544    4.39295  -0.156 0.877212
Experience2   0.52103    3.46660   0.150 0.881687
Experience3  -3.75421    4.18151  -0.898 0.377525
Experience4   2.14258    3.39345   0.631 0.533301
Experience5   0.41289    4.00954   0.103 0.918771
Experience6   8.35343    6.43879   1.297 0.205901
Experience7   2.86205    4.26619   0.671 0.508221
Experience8   2.25043    4.30669   0.523 0.605717
Experience9   6.47136    5.41802   1.194 0.243099
Experience11 12.06361    7.36736   1.637 0.113587
Experience12  1.76229    4.11435   0.428 0.671941
Prof.Cat1     1.63456    1.84433   0.886 0.383602
B.1           0.10697    0.11182   0.957 0.347572
B.2           0.02623    0.07737   0.339 0.737332
B.3           0.12132    0.10127   1.198 0.241723
B.4          -0.26968    0.13920  -1.937 0.063642 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.898 on 26 degrees of freedom
Multiple R-squared:  0.6395,	Adjusted R-squared:  0.3344
F-statistic: 2.096 on 22 and 26 DF,  p-value: 0.03612
```

FIGURE 6. Multiple linear regression model for B.5.

In order to confirm the statistical significance of each socio-demographic factor in the multiple linear regression models, regression models were calculated automatically with the algorithm regsubset and with the Bayesian Information Criterion (BIC) in the significant models: B.1 (figure 7), B.4 (figure 8) and B.5 (figure 9). The variables shaded black contributed significantly. Hence, for B.1 we find kind of centre, prior training on ICT, teaching experience of eight, 11 and 12 years, and the security area (B.4). The main areas in B.4 are kind of centre, prior training on ICT, degree, teaching experience of three years, and problem solving (B.5). B.5 shows kind of centre, prior training on ICT, professional category and the areas of digital content creation (B.3) and security (B.4).

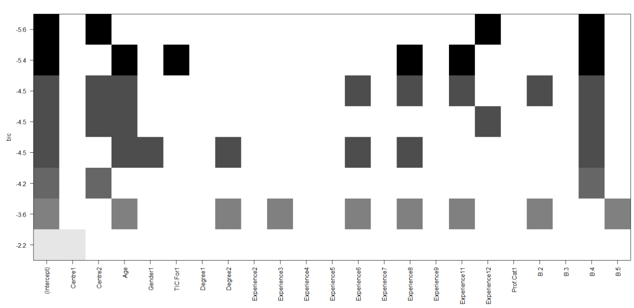

FIGURE 7. Automatic regression model for B.1.

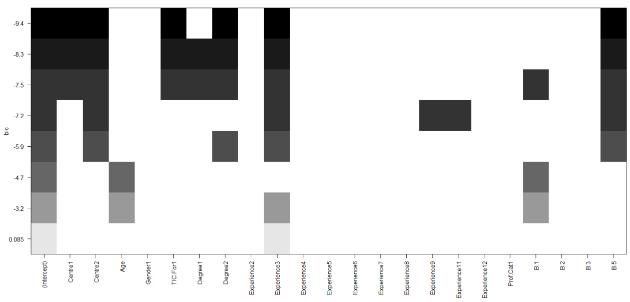

FIGURE 8. Automatic regression model for B.4.

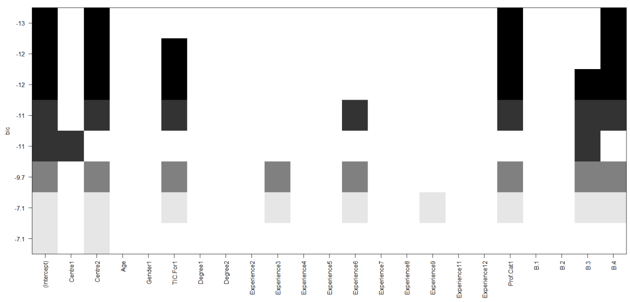

FIGURE 9. Automatic regression model for B.5.

Finally, with the aim of completing the regression analysis, a Deep Learning regression model with H20 was implemented in areas B.1, B.4 and B.5 to specify the root mean square error (RMSE) with a tanh function activation. The results showed that the RMSE was 5.25 for B.1, 3.99 for B.2, and 2.40 for B.3. B.2 and B.3 had good results. As a synthesis of the above, table 3 shows the impact of each socio-demographic factor, according to the digital competence area.

TABLE 3. Influence of sociodemographic factor according to the digital competence area.

Socio-demographic factor	Area				
	B.1	B.2	B.3	B.4	B.5
Centre	O			X, O	O
Age	X				
Gender					
Previous ICT training	O			O	O
Degree				O	
Teaching experience	X, O	X		X, O	
Professional category					O

Note: B.1 = Information and data literacy; B.2 = Communication and collaboration; B.3 = Digital contents creation; B.4 = Security; B.5 = Problem solving; X = significance in the multiple linear regression model; O = significance in the automatic regression model.

V. DISCUSSION

This study focused mainly on analysing the digital competence level of Permanent Education teachers, and determining the factors that have an impact on the digital competence development. The findings evidence that the digital competence level for teachers is low, and they detect certain socio-demographic factors that have a significant impact on the acquisition of digital competence, according to each area.

It is confirmed that adults show a low digital competence [8], [20], [21]–[23]. This is reflected in the average scores obtained in each area that were situated below a neutral value (5). For instance, the area of digital content creation is particularly low.

According to the general frameworks of digital competence, the Permanent Education teachers of Andalusia would fall within the following levels: integration [12]; beginner [13]; A2-explorer [14], [16]; and basic [15]. This confirms the need to have digitally-skilled teachers [3], [4], [10].

Likewise, the multiple linear regression models confirm the influence of socio-demographic factors in digital competence development [9] [29], [30]. Hence, factors like age, teaching experience and the area of communication and collaboration weigh on the area of information and data literacy. Nevertheless, for the area of communication and collaboration, only teaching experience and the area of information and data literacy have an impact. To this regard, there is reciprocity between the areas of information and data literacy, and communication and collaboration, which are the basic or elementary areas of digital competence acquisition [15], [19]. In contrast, the area of digital content creation (the area with the lowest scores) has no influence on any factor. The security area receives the impact of the kind of centre and the teaching experience. Finally, the problem solving area does not register any influencing factors.

The analysis of the multiple linear regression models with significant values through the automatic regression models reflects the purification of the socio-demographic factors influencing digital competence development. Therefore, this materialisation indicates that in terms of information and data literacy, the kind of centre, prior training on ICT, teaching experience of eight, 11 and 12 years, and the security area have an important weight. For the security area, we can remark the kind of centre (CEPER and SEPER, IES), prior training on ICT, degree (Master's Degree), teaching experience of three years, and the problem solving area. Regarding the latter, it includes the kind of centre (only IES), prior training on ICT, professional category and the areas of digital content and security. The data evidence that teaching experience is the socio-demographic factor with the greatest impact on digital competence acquisition, particularly experience of between eight and 11 years. Furthermore, the fact of having had more years of teaching experience leads to achieving a higher digital competence level.

In addition, significant relationships are observed within the areas of digital competence. As a result, certain links have been generated between the area of information and data literacy, and communication and collaboration, and security; between communication and collaboration, and information and data literacy; between security and problem solving; and between problem solving and digital content creation and security. This fact verifies that these areas are not isolated, but they interact significantly in digital competence development and acquisition.

Lastly, concerning prior studies, it is stated that there is an influence on the digital competence development of socio-demographic factors by: age and professional category [9], [31], [33]; teaching experience [9], [31]; and prior training on ICT [9], [28], [32]–[34]. Nonetheless, unlike other studies, the impact of the gender factor is excluded [33].

In summary, these findings indicate the relationship of certain sociodemographic factors with areas of digital competence. The difference in each area is substantial, since each one refers to certain guidelines of digital competition, so it is not surprising that different sociodemographic factors influence each area. The areas of greatest influence are information and data literacy (B1) and security (B4). With respect to the influence of factors in specific areas, this may be due to several reasons: the centre where teachers work determines the acquisition of areas B1, B4 and B5, possibly due to the difference in technological resources available in each type of centre. In the case of IES, technological material is usually more abundant due to the high number of students exceeding those enrolled in CEPER or SEPER. In relation to age (influential in B1), the generational variable is explanatory in some cases of the use of technology, where it is attributed that younger teachers use it more frequently than older teachers [20]. Previous ICT training has a direct impact on digital competence areas B1, B4 and B5, since this type of training focuses on training teachers in the use of technological tools, where the most basic level of digital competence (B1) is revealed and guidelines are established on security and problem solving. On the one hand, teaching experience is key to the development of areas B1, B2 and B4, years of experience act as moderators of teaching behaviour, so it is not surprising that the greater the experience, the higher the degree of information and data literacy, as well as the fact of using communication and collaboration network tools. In this sense, experience can make teachers evolve methodologically and give them the wisdom to know which technological tools are the most appropriate. Something similar happens with security, where the greater the degree of experience, the greater the security mechanisms are established, possibly due to the reflection of the teaching given in previous years and the testing of different technological resources.

On the other hand, the professional category has been a determinant of area B5, the existence of this link is really interesting, since it differentiates between temporary and permanent teachers in terms of problem solving. This factor has indicated that temporary teachers present a greater resolution of problems with technology, possibly this influence is due to the temporary nature of their job and the fact that they rotate through different schools.

Finally, the degree is determinant of the B4 area, depending on the university degree studied, different knowledge and perceptions are acquired about network security. This is the case of teachers who have studied in the scientific branch. The level in the area of security is higher than those who have studied in the humanities. This may be due to the scientific tradition of each area of knowledge, where traditionally the scientific branch is linked to practical knowledge while the humanistic branch is linked to philosophical knowledge [39]. In the end, no sociodemographic factor is determinant for the creation of content (B3). This, in turn, has been the area with the lowest score, denoting the possibility that only a minority of the teachers surveyed generate their own digital resources while the rest use resources already created. In consideration, this may have been the main cause of not generating influential sociodemographic factors.

VI. CONCLUSION

The adult population is at a disadvantage when it comes to digital competence development and acquisition, due to the lack of ICT training in the first instance. The desire to make progress and get familiar with technology, together with the years of teaching experience are the main factors that contribute to Permanent Education teachers' digital competence.

This study has responded to the aims pursued on analysing the digital competence level of Permanent Education teachers, and determining the factors that have an impact on digital competence development. In the same way, the research questions raised were addressed, where: (RQ1) The level of digital competence acquisition is low. It reaches neither average values nor optimal values, which results in a limited aptitude in every area of digital competence, among which the creation of content shows the lowest aptitude. Concerning the general framework for digital competence, the Permanent Education teachers would be categorised in the most basic levels; (RQ2) There is a significant influence on digital competence, based on the fact of belonging to a CEPER and SEPER, or to an IES. This incidence is particularly clear in the information and data literacy, security and problem solving areas. To this regard, data evidence that teachers of IES show a higher teacher's digital competence; (RQ3) Age is another conditioning factor when developing digital competence, especially in the information and data literacy areas. As a result, the fact of being competent in the most basic area of digital competence depends, in the first instance, on the teacher's age; (RQ4) None of the multiple linear regression models notes gender as an influencing factor in digital competence; (RQ5) Qualifications condition training in the security area. Hence, there is a difference between completing a Bachelor's Degree, a University Degree and a Master's Degree. The qualification with the greatest impact on digital competence development is the Master's Degree; (RQ6) Teaching experience is also a conditioning factor in those teachers with eight or 11 years of experience, who show a higher level of digital competence for teachers. Moreover, this factor is significant in the information and digital competence, collaboration and security areas; (RQ7) Professional category affects digital competence development, mainly the problem solving area.

It is necessary to remark among all the limitations for this study that access to the sample was difficult. It is a limited group that often has few teachers in a single academic centre, with even a maximum of three to six teachers per centre. Consequently, the sample achieved is quite wide in relation to the study population. The instrument used is too long; future studies should reduce certain items. Yet, this application with all the items has made it possible to faithfully reflect each area of digital competence. Furthermore, another limitation is the purely descriptive character of the research, in future works it would be convenient to include direct measures to deepen in the why of the findings of the study.

Finally, the following ideas could be addressed in future research lines and works:(i) extension of the sample all over Spain to know whether these data remain at a national level; (ii) comparison between Permanent Education teachers and Primary and Secondary Education teachers; (iii) broadening the socio-demographic factors to verify whether there are more that affect digital competence development; (iv) design and application of training programmes to increase digital competence; and (v) study of digital competence of Permanent Education students.

Concerning the study, there is still some way to go in terms of digital training for the real inclusion of technology and to achieve technological literacy, identity and humanism. The first step for this aim is to develop the necessary skills to apply the wide range of technological resources that are accessible to teachers. Hence, we will be able to progress towards student-centred learning, with technologies that facilitate the adaptation of the contents to each individual's learning rhythm, and based on network working and the promotion of active methodologies.

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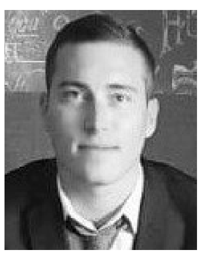

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