Comparative research in the digital competence of the pre-service education teacher: face-to-face vs blended education and gender

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Abstract

To evaluate the digital competence of pre-service teacher, three sub-scales must be considered: attitude, knowledge and use. However, the degree of acquisition may vary depending on different variables. The main objective of this research is to find out the level of digital competence of university students based on these three sub-scales, and, as secondary objectives, to find out whether any differences exist in relation to students’ educational modality and gender. A non-experimental design has been used (ex post facto) with a sample of 675 students from the Pontifical University of Salamanca. The results revealed that the level of digital competence of the pre-service education teacher is medium, with no significant differences in gender. However, differences were found in the Blended Learning modality.

KEYWORDS: Digital Competence; ICT; Students Profile; Educational Modality.

1. Introduction

Compared to some decades ago, the profile of university students has now changed. Modern-day students are part of a new generation who have grown up surrounded by technological devices, as well as all the possibilities offered by internet access. This has fostered the development of skills and attitudes towards Information and Communication Technologies (ICT) in any social and educational context (Ojando et al., 2017).

Current university students can be considered as “net generation” or “digital natives” (Thompson, 2013; Bowe & Wohn, 2015). However, even if said students are called “digital natives”, this does not ensure that they have developed digital competence, and even if they have, it would be necessary to find out the level of acquisition that they possess (Barak, 2018). In this sense, Kennedy and colleagues (2007), point out that, as a general rule, students’ digital competence focuses on the development of skills, attitudes and knowledge of technologies in social and playful contexts, and does consider their transfer to educational contexts, which propitiate optimal teaching-learning processes, which is necessary for the successful construction of knowledge.

It is no longer enough to have digital literacy, understood as the minimum set of skills that allow a user to operate effectively with software tools, access to the internet or perform basic tasks with a computer (Buckingham, 2015; Van Laar et al., 2017). Nowadays,
it is necessary to go one step further than digital literacy towards digital competence, which is understood as the domain of ICT in a professional context with good pedagogical-didactic judgment (Krumsvik, 2011). According to Ferrari (2012), digital competence can be defined as a set of knowledge, skills and attitudes towards ICT and digital media. On the same lines, Council (2006) defines it as the knowledge, skills and attitudes that a user must have to work, live and learn in a knowledge society. Different dimensions should be included in the development of digital competence: a first dimension that encompasses basic digital competences (use of ICT tools, access to information etc.); a second dimension constituted by didactic competence in ICT management, where technology is understood at the service of pedagogy; and a third dimension, shaped by the development of the competence to learn through ICT, i.e., its use transversally (Krumsvik, 2007).

In this current socio-educational background, teacher training institutions have to focus on a good educational quality training in order to ensure the incorporation of future teachers into the labour market and professional market (Kaufman, 2015; Maxwell and Schwimmer, 2016). This is because technological education now plays a vital role in the learning that takes place (Tondeur et al., 2016). In recent years, much research has been conducted on the perception of future teachers about the knowledge, use, implementation and integration of ICT in the teaching process (Casillas et al., 2017), since having a basic knowledge of ICT is no longer enough. Instead, it is fundamental that teachers have the necessary skills, knowledge and attitudes to carry out the teaching-learning process effectively (Baylor & Ritchie, 2002).

The purpose of this research is: (1) to know the level of digital competence of the pre-service education teacher and (2) to compare the level of digital competence according to the educational modality and gender.

2. Related Works

2.1 Digital Competence in Different Educational Modalities

During the last decade, a new educational modality called Blended Learning has emerged, which combines face-to-face teaching and online teaching (Hannay & Newvine, 2017) and reduces the time spent attending classes (Asarta & Schmidt, 2017). Thus, it provides an enriching experience that combines the benefits of new technologies with face-to-face social interaction (Van Doorn & Van Doorn, 2014). In addition, Blending Learning allows students to optimise their learning at their own pace (Arbaugh, 2014) since the focus of attention in the teaching-learning process their own learning (Bartolome, 2004), even if teachers continue to play a fundamental role in providing structure, organisation and learning experiences to students (Megeid, 2014; Al다과이, 2015; Broadbent, 2017), providing them resources which facilitate explore and develop new skills. This type of methodology allows them to develop new skills and abilities (Carranza & Caldera, 2018).

The potential of these courses, therefore, is to grant students more responsibility, control and independence, as well as to improve their critical and reflective abilities (Garrison & Kanuka, 2004). Students themselves have found Blended Learning to provide positive results (Davies et al., 2013; Garcia et al., 2013; Hannay & Newvine, 2017), improving their academic performance, specifically when compared to the face-to-face modality (Albert & Beachy, 2014; Baepler et al., 2014).

Regarding students’ perception, Eryilmaz (2015) carried out a pre-experimental study to measure the affectivity of Blended Learning, comparing it with the face-to-face modality (N = 110) in Atılım University, Ankara (Turkey). The results showed statistically significant differences in the opinions of students (p = 0.001), thus showing that the face-to-face modality was more effective. On the same lines, Tseng and Walsh (2016) compared and evaluated the perceptions, motivations and academic results of a total of 52 students, which were divided into two groups: Blended Learning and face-to-face. The results showed that the students in the Blended Learning modality had a higher motivation (p = 0.045), although there were no significant differences in academic performance (p = 0.192).

In relation to academic performance, Al-Qahtani and Higgins (2012) conducted a study with 148 students from A-Qura University in Saudi Arabia. The results showed that there were statistically significant differences between the Blended Learning modality and face-to-face learning (p = 0.001), with an effect size of 1.34 (Hedges’g), indicating that Blended Learning had a positive impact on improving student performance. These results are consistent with those obtained in other studies (Lewis & Harrison, 2012 Harjoto, 2017).

On the contrary, there are other investigations where no statistically significant differences have been found between the two educational modalities (Ashby et al., 2011; Aly, 2016).

Considering the existing literature regarding both educational modalities, it is clear that there is no consensus on the results obtained by the different investigations. On the other hand, it is noteworthy that most of the studies are focused primarily on analysing the perception and performance of students. There is more limited literature regarding the comparison of the digital competence of students in different educational modalities (Garcia et al., 2013). For this reason, this work focuses the interest on analysing the digital competence of students, specifically comparing Blended Learning with face-to-face learning.
2.2 Digital Competence According to Gender

In terms of gender, there are numerous studies which consider there to be considerable differences between males and females. For example, many researchers have found males to have a greater preference for ICT than females (Incantalupo et al., 2013; Balta & Duran, 2015; Ilkan et al., 2017; Seok & DaCosta, 2017). These results are corroborated by other authors where males obtained better results in digital competence (Casillas et al., 2017; Flores & Roig, 2017; Cabezas et al., 2017). Toundeur and colleagues (2016) conducted a study with 1,138 university students in Flanders (Belgium). The results showed that females had a less favourable attitude towards ICT than males, although there were no differences in educational contexts. On the other hand, there are authors who have determined that women have a higher digital competence than men (Suri & Sharma, 2013; Aesaert & Van Braak, 2015; Krumsvik et al., 2016; Guillén-Gámez et al., 2019).

On the contrary, there are studies where no statistically significant differences have been found in digital competence with respect to gender (Stosic & Fadiya, 2017; Vázquez-Cano et al., 2017; Dauda et al., 2017; Ayanda & Jibrin, 2018).

2.3 Digital Competence According to its Three Dimensions: Knowledge, Attitude and Use

There are studies that analyse the different dimensions that make up digital competence (Incantalupo et al., 2014; Onwuagboke & Singh, 2016; Pelto et al., 2017; Bindu, 2017). Kandasamy & Shah (2013) conducted a study with 100 primary education teachers whose results revealed that these teachers had knowledge about the use of applications, such as MS Word and Power Point, email and internet exploration. Most of them had a positive attitude towards the use of ICT. Taking gender into account, Tezci (2010) concluded that male teachers obtained higher scores in terms of knowledge and use, as well as a more positive attitude than female teachers. However, other studies affirm that, although teachers have positive attitudes towards ICT, they lack the necessary knowledge to put it into practice in an appropriate way from a pedagogical point of view (Tezci, 2010; Mahmoud & Ismail, 2010; Slechtova, 2014; Ilkan et al., 2017; Fadiya, 2017). On the same lines, Prior and colleagues (2016) conducted a study with 151 university students, concluding that a positive attitude towards ICT and adequate digital literacy contribute significantly to the development of digital competence through the ability to learn. These results are corroborated by those obtained by Adewole-Odeshi (2014). On the contrary, other researchers have concluded that teachers have a negative attitude towards ICT (Uluyol & Sahin, 2014; Dauda et al., 2018; Guillén-Gámez et al., 2018).

The attitude of use has also been related to other variables, such as years of experience or age, and the degree or level of study (Volman et al., 2005; Kubiakto, 2010; Slechtova, 2014; Adebara et al., 2017). Some studies have concluded that those at a younger age have a less positive attitude towards the use of ICT (Tezci, 2010; Balta & Duran, 2015).

Considering the scientific literature, there is hardly any research which compares the level of digital competence of the pre-service education teacher in different educational modalities (face to face vs. blended learning) as well as in gender. Therefore, this research aims to assess the level of digital competence of pre-service teacher in different educational modes according to gender.

3. Methods

Design: A non-experimental, ex-post facto cutting design was used. A descriptive analysis, followed by an inferential one, has been carried out. The level of significance established was sig. <0.05, which meant working with 95% confidence and 5% error.

Participants: A non-probabilistic sample has been used intentionally. The sample consisted of a total of 675 pre-service teacher enrolled in the Faculty of Education of the Pontifical University of Salamanca (UPSA). Data collection was carried out in the 2018/2019 academic year. The predominant gender was female (60%) with an average age of 27 years compared to male (40%) with an average age of 24 years; while the number of students in the classroom modality was higher (61.63%) compared to Blended Learning (38.37%).

Description of Educational Modalities: Students enrolled in the Blended Learning modality had to attend in person and mandatory once every month (in total 4 times in the semester). The time of each subject depended on the credits of each subject (between 1 and 2 hours), and a compulsory virtual assistance of 21 hours per semester. On the other hand, students enrolled in the classroom modality attend class with a total of 60 hours per semester.

Instrument. For the collection of the data for this research, the ACUTIC instrument was used (Mirete, 2015), which has been applied in different types of samples and educational stages (Mirete, 2016; Guillén-Gámez & Peña, 2020). The original instrument showed good results of reliability for its subsequent application. The ACUTIC is composed of three-dimensions, attitude, knowledge and use. It consists of 31 Likert-type items of 5 points, however, the authors consider adding two more items on the knowledge and use about the creation of interactive questionnaires (Googleforms, Socrative, QuizWorks). Therefore, the final version of the instrument had 33 items. In this questionnaire, the
students must respond according to their degree of agreement with the proposed statement (for the attitudes dimension: from completely disagree (0 points) to fully agree (4 points); and for the knowledge dimension: from no knowledge (0 points) to very high knowledge (4 points); and finally, for the use dimension: from no use (0 points) to always use it (4 points).

The attitudes towards ICT dimension was composed of 7 items focused on thoughts, beliefs or attitudes towards ICTs (e.g. ICT promote involvement in the teaching and learning processes). Taking into account the Likert scale used, the maximum score to be reached by a participant in this dimension was 28 points. The knowledge dimension consisted of 13 items related to knowledge or training towards digital technologies, web resources or 2.0 tools (e.g. knowledge in Libraries and digital databases: Dialnet, Theseus, Los, Scopus). The maximum score to be reached in this dimension is 52 points. Finally, the use dimension was composed of the same 13 items as the knowledge dimension, with the difference of focusing on the use that students make about them (e.g. use of data analysis software: SPSS, R, Mystat, Nud.ist, Nvivo, Atlas.ti). The maximum score to be reached in this dimension is 52 points. Finally, the maximum total score in the ACUTIC is 132 points.

The overall reliability of the instrument was calculated through Cronbach’s alpha with a very satisfactory value (α = .932). Specifically, this reliability was calculated for each of the dimensions of the instrument through the Cronbach, Spearman-Brown and Guttman Alpha coefficients (Table 1). All of them very satisfactory.

<table>
<thead>
<tr>
<th>Level</th>
<th>Alpha de Cronbach</th>
<th>Coeficiente de Spearman-Brown</th>
<th>Dos mitades de Guttman</th>
</tr>
</thead>
<tbody>
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<td>.886</td>
<td>.871</td>
</tr>
<tr>
<td>Knowledge (KD)</td>
<td>.899</td>
<td>.782</td>
<td>.779</td>
</tr>
<tr>
<td>Use (UD)</td>
<td>.860</td>
<td>.679</td>
<td>.676</td>
</tr>
</tbody>
</table>

Table 1 - Reliability statistics of the three dimensions of the instrument.

4. Results

4.1 Total Digital Competence of Students According to the Instrument’s Scales

Table 2 presents the descriptive data in each of the scales (the score of each scale is composed of the sum of the score of the items that compose it), showing the mean (M), standard deviation (SD), asymmetry (A) and kurtosis (K). It is observed how the students have a medium-low knowledge and use of ICT (knowledge = 27.69; use = 25.93) with respect to the attitude scale which is quite favourable (M = 21.72). Regarding the total digital competence, the students show that they have a medium competence (M = 75.34).

<table>
<thead>
<tr>
<th>Scale</th>
<th>M</th>
<th>SD</th>
<th>A</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude (AD, 28 points)</td>
<td>21.72</td>
<td>4.94</td>
<td>.88</td>
<td>0.82</td>
</tr>
<tr>
<td>Knowledge (KD, 52 points)</td>
<td>27.69</td>
<td>5.55</td>
<td>.20</td>
<td>.08</td>
</tr>
<tr>
<td>Use (UD, 52 points)</td>
<td>25.93</td>
<td>9.02</td>
<td>.40</td>
<td>.32</td>
</tr>
<tr>
<td>ACUTIC (132 points)</td>
<td>75.34</td>
<td>19.87</td>
<td>.08</td>
<td>.66</td>
</tr>
</tbody>
</table>

Table 2 Descriptive data of the degree of acquisition of digital competence

4.2 Digital Competence of Students According to Modality and Gender

Table 3 analyses the differences in gender within each educational modality, while Table 4 compares educational modalities based on gender. It can be seen that in the total scale (KS= .056; sig. > .05), the data follows a normal distribution; therefore, the parametric t-student test was used to check the difference of means between both distributions.

Table 3 shows how there are significant differences in the Blended Learning modality according to gender, but no differences are found in the students who study in the traditional modality. In addition, it is observed that in the total scale, males had a higher score than females. Regarding the effect size calculated through the d (cohen), it can be seen that the strength of the difference of means between both genders in the Blending Learning modality was .29.

According to the full scale of Table 4, it can be observed that there are only significant differences for males when comparing students of both educational modalities (sig .001), while for females, there are no significant differences (sig .666). Regarding the size of the effect, it can be observed that it is moderate in both scales. On the other hand, it can be seen that male students in the Blended Learning modality (BL) have a more favourable degree of digital competence than male students belonging to the face-to-face modality (Mface-to-face = 73.08; MBlended = 84.00). Although there are no significant differences for females, there is a difference of three points in terms of digital competence (Mface-to-face = 73.11; MBlended = 76.96).

5. Discussion

According to Mirete and colleagues (2015), knowing students’ attitudes, knowledge and use of ICT can facilitate their inclusion in educational processes and the
transition towards an educational model centred on the student. Although current university students can be considered as "net generation" or "digital natives" (Thompson, 2013; Bowe & Wohn, 2015), the results obtained in this study reflect that the level of digital competence of university students is medium (M = 75.34 over 132 points).

Regarding the dimensions of digital competence, the results show that the attitude of students is quite favourable, similar to the results obtained by Kandasamy and Shah (2013). However, the scores reveal that the students consider that their knowledge and use of ICT is medium-low. These results coincide with studies that state that teachers and future teachers can have a favourable attitude towards ICT, yet lack the necessary knowledge (Mahmud & Ismail, 2010; Slechtova, 2013; Ilkan et al., 2017; Stosic & Fadiya, 2017).

Tezci (2010) mentions that attitude affects knowledge, as well as its use. In our study, we have observed that a favourable attitude towards ICT correlates significantly with knowledge and use. Following the line of other authors, such as Adewole-Odeshi (2014) and Prior and colleagues (2016), a positive attitude towards ICT and an adequate digital literacy can favour the development of digital competence.

In relation to gender, as in previous research (Stosic & Fadiya, 2017; Vázquez-Canó et al., 2017; Dauda et al., 2018), no statistically significant differences were found in this study considering the total sample. Regarding the comparison of both modalities classified by gender, the scores were higher in the Blended

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th>M</th>
<th>SD</th>
<th>A</th>
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<tr>
<td>AD</td>
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<td>M</td>
<td>21.47</td>
<td>4.47</td>
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<td></td>
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<td>F</td>
<td>76.96</td>
<td>22.12</td>
<td>-0.13</td>
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Table 3 - Descriptions and significance of both modalities comparing gender.

<table>
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<tr>
<th></th>
<th>Sex</th>
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<th>SD</th>
<th>A</th>
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Table 4 - Descriptions and significance in gender comparing both modalities.
Learning modality than the face-to-face modality, with statistically significant differences only for males. These results coincide with previous studies (Al-Qahtani & Higginst, 2012; Lewis & Harrison, 2012; Harjoto, 2017) in which Blended Learning had a positive impact on improving student performance.

6. Conclusions

In today’s society, digital competences are becoming increasingly relevant and necessary to function both personally and professionally. Future teachers need to be able to facilitate teaching-learning processes through ICT that allows the development of digital skills in their students from the earliest stages. In this study, it has been observed that the general level of digital competence of university students is medium. Although their attitude toward ICT is favourable, their knowledge and use are medium-low.

One of the limitations of this study was the size of the sample, since only students in the Faculty of Education at one university were considered. In future studies, the sample could be expanded, observing whether there are differences depending on the type of university, its geographical location, as well as for degrees. In the same way, it would be interesting to find out and compare the degree of digital competence of students with that of their teaching staff.

The results of the study indicate the need to improve educational quality regarding training in digital competences of future teachers. More studies are needed to analyse the explanatory factors of this situation, as well as the demographics and social, psychological, educational and cultural impacts. Furthermore, future studies must address the implementation of strategies and actions that contribute to an improvement of the digital competence of university students. For example, it would be interesting to consider a mixed method approach as strength, since a methodology with quantitative techniques backed by a qualitative methodology through oral interviews on the students' points of view, would add richness to the interpretation of the data.

References


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