An evaluation of Primary-School pupils’ Digital Competence

Evaluación de la Competencia Digital en el alumnado de Educación Primaria

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Received: 19/03/2019 • Approved: 01/06/2019 • Published 24/06/2019

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ABSTRACT:
The use of Information and Communication Technologies (ICT) and the ability to relate through the use of social networks have a significant influence on the development of Digital Competence. The objective of this study is to discover the amount of time pupils spend on activities related to digital media outside school hours, and to identify the skills acquired through these activities, in addition to their benefit as regards pupils' learning and their increase in Digital Competence.

Keywords: Information and Communication Technologies, Digital Competence, Primary Education

RESUMEN:
El uso de las Tecnologías de la Información y la Comunicación (TIC) y la habilidad para relacionarse a través de redes sociales influyen de forma significativa en el desarrollo de la Competencia Digital. El objetivo del presente estudio es conocer el tiempo que le dedica nuestro alumnado a actividades relacionadas con los medios digitales fuera del horario escolar, e identificar las habilidades adquiridas a través de estas actividades y su beneficio para el aprendizaje escolar y el incremento de la Competencia Digital.

Palabras clave: Tecnologías de la Información y la Comunicación, Competencia Digital, Educación Primaria

1. Introduction

This work is focused on pupils’ perceptions of their level of development as regards Digital Competence, i.e. their skills and abilities in the use and control of digital and analogical means of communication. The group that participated in this study, whose members were aged between 10 and 13, belong to a digital generation that maintains direct and continuous contact with the most common Information and Communication Technologies (ICT) in present-day society (Delicado & Alves, 2010; Pereira, Pinto & Moura, 2015). For that reason, we shall also attempt to analyse the relevance that the use and handling of these media have in their daily lives, along with the contribution that they make to the acquisition and development of their Digital Competence. We are of the same opinion as Buckingham (2005) in that the way in which these media are used at and outside school is so different that a new type of digital distribution is emerging. The difference between what pupils learn in the classroom and what they learn elsewhere is, therefore, becoming increasingly more relevant (Pereira, Fillol & Moura, 2019), since the school is, on occasions, unable to provide or combine certain types of learning. According to Gee (2004, p.77), "people learn better when the learning forms part of highly motivated participation that they value", in this case, digital means of communication and social networks.

This type of ‘informal’ education (Buckingham, 2005; Erstad & Sefton-Green, 2013; Scolari, 2018) plays an important role for pupils, since it begins with their interests and needs, in addition to the fact that it is shared with their peers and family members. All these agents have a great influence at that age and, therefore, tend to be fundamental sources of knowledge for them. The amount of time spent doing these activities is also a key factor for as regards attaining digital abilities and is, therefore, dealt with in this study, along with determinant variables, such as gender and attending extra-curricular computing classes.

1.1. The Competences in Primary Education

Competence-based learning is characterized by its transversal nature, its dynamism and its integral nature, and the process of teaching/learning these competences should, therefore, be tackled in all knowledge areas and all those people of which the educational community is composed (De la Orden, 2011). These competences are not acquired at a particular moment and then remain unalterable, but rather imply a process of development through which individuals gradually acquire greater levels of performance in their use, thus giving them a certain dynamic nature. Tackling them also implies an integral education that will allow pupils to transfer the knowledge acquired throughout
Digital Competence and its evaluation with primary school pupils.

1.2. Digital Competence and its evaluation with primary school pupils.

Improving Digital Competence as regards educating pupils favoured the inclusion of Information and Communication Technologies (ICT) in schools. The ICT domain is fundamental in present-day society, and education and the role of the teacher are very important as regards the acquisition of this ability (Bas, Kubiatko & Murat, 2016). The provision of resources with which to facilitate access to technologies has, therefore, been one of the crucial elements in relation to the acquisition of this ability (Bas, Kubiatko & Murat, 2016). The provision of resources with which to facilitate access to technologies has, therefore, been one of the crucial elements in relation to the acquisition of this ability (Bas, Kubiatko & Murat, 2016).

The Royal decrees concerning minimum learning specify these competencies and define their development at each educative stage in the Royal Decree on Primary Education 1513/2006 and the Order of the 17th March, 2015, showing the specific contribution made by each competency to the development of each educative stage (Tiana Ferrer, 2011).

The European Commission (2013, 2011) recommends a series of key competencies that its member states must ensure are acquired by all, and which are the following:

- Communication in the native language.
- Communication in foreign languages.
- Mathematical competence and basic competences in science and technology.
- Digital competence.
- Learning to learn.
- Interpersonal, intercultural and social competences and civic competence.
- Undertaking initiatives
- Cultural expression.

The Spanish Organic Laws for Education (LOE, 2006; LOMCE, 2013) later stated that the curriculum is a set of objectives, basic competences, contents and pedagogic methods and evaluation criteria of each of the areas of teaching, and established the following basic competences for the Spanish education system:

1. Competency in linguistic communication.
2. Mathematical competence.
3. Competence as regards the knowledge of and interaction with the physical world.
4. Dealing with information and digital competence.
5. Competence as regards society and citizenship.
6. Cultural and artistic competence.
7. The competence to learn to learn.
8. Autonomy and personal initiative.

The Royal decree concerning minimum learning specify these competencies and define their development at each educative stage in the Royal Decree on Primary Education 1513/2006 and the Order of the 17th March, 2015, showing the specific contribution made by each competency to the different areas or subjects on the curriculum.

1.2. Digital Competence and its evaluation with primary school pupils.

Improving Digital Competence as regards educating pupils favoured the inclusion of Information and Communication Technologies (ICT) in schools. The ICT domain is fundamental in present-day society, and education and the role of the teacher are very important as regards the acquisition of this ability (Bas, Kubiatko & Murat, 2016). The provision of resources with which to facilitate access to technologies has, therefore, been one of the crucial elements in relation to avoiding inequality among pupils. There are, nevertheless, still differences in the way in which pupils develop these competences that concern individual, socio-economic and family-related factors (Moreno, Guzmán & García, 2017).

Digital Competence supposes having the skill to handle and use ICT and is measured by employing indicators that show the perception that individuals themselves have about their abilities to use ICT with regard to surfing the Internet: seeking, finding and organising information, creating databases; handling a computer: creating graphics,
We then used the Cronbach's Alpha to carry out an analysis of the global reliability and individual variances of each competency and how much time they dedicate to activities related to using the computer, computing, social networks, etc. (Zhong, 2011; Van Braak & Kavadias, 2005; OECD, 2010). One of those most frequently used in empirical analyses is the pupils' confidence when handling technologies, i.e. their own perceptions of their efficiency as regards these aspects. The most recent lines of research are focussing on the way in which young people use devices (Selwyn, 2004), in order to discover whether they are capable of obtaining greater benefits from them, and the differences among them in relation to their abilities to handle these technologies (Hatlevik & Christophersen, 2013). Both boys and girls generally state that their level is higher than that which they actually have, and what is more, there are variables such as gender. For example, boys automatically assume that they are more competent in these skills. Moreover, the pupils' socio-economic level may facilitate their access to technologies, and the type of education centre at which they are studying may have an influence, because there may be differences among the infrastructures and educational resources that they have (Kuhlmeier & Hemker, 2007).

Although this piece of data may obviously represent a good approximation to Digital Competence, existing evidence shows that pupils state that they have a higher level than is actually the case and that there is a relationship among certain characteristics related to them, such as gender and the tendency to exaggerate certain competencies, i.e. males stating that they have a better digital competency than they really have (Gee, 2004; Kuhlmeier & Hemker, 2007; Pereira, Fillol, & Moura, 2019). However, the study by Aesaert & Braak (2015) concluded that girls have better technical abilities than boys.

The level of classmates' competences may also be a predictive variable as regards pupils' digital competence. It would appear to be logical that a pupil's digital competency will improve when his or her classmates show that they have better skills with new technologies. In all cases, the causal relationship between the pupil's competence and the average competence of his or her classmates probably moves in both directions in a reciprocal manner. The solution is to use a variable that is truly exogenous, i.e. that is more closely related to the characteristics of the pupils or their families than to their behaviour (Pereira, Fillol & Moura, 2019). We consider that access to technology outside the education centre may also be an important external variable with which to measure these abilities, since better access to ICT has a positive influence on a pupil's acquisition of digital competence.

2. Methodology
The method employed in this research is based on a quantitative methodology of a descriptive and comparative nature.

2.1. Objectives
To discover the level of development of Digital Competence in Primary School pupils in their sixth year. To analyse the relationship between the level of development of Digital Competence and the amount of time that the pupil spends doing activities with the computer outside the classroom.
To verify whether there are differences in the development of Digital Competence according to gender.

2.2. Sample
The present study was carried out with the participation of a total of 343 Primary School pupils in their sixth year, of which 48.4% were boys and 51.6% were girls. Of this total, 212 (61.8%) were at state schools and 131 (38.2%) were at private schools. All were studying in the city of Córdoba (Spain), and were aged between 10 and 13 (M=11.13; D.T.=.382).

2.3. Instrument
We designed an ad hoc questionnaire in order evaluate abilities and skills, consisting of the development and acquisition of the key competences in the sixth year of Primary Education. The questionnaire was created after reading specialised literature on this subject, while the validation was carried out by experts in teaching at that stage in education. After consulting detailed up-to-date scientific material, we obtained a set of fundamental perceptions that related the items of the instrument with the research objectives.

The questionnaire reflects the different variables being studied and each item was defined operationally. In order to validate the instrument (calculate its reliability), we used Cronbach’s Alpha, and obtained a total of .96 with a confidence level of 95%. As a general criterion, George and Mallery (2003, p.231) suggest that, when evaluating research, an Alpha Coefficient of >.9 is excellent.

The questionnaire was formed of a total of 82 items related to the development and acquisition of basic competences in accordance with the Order of March 17th, 2015, which consequently led to the development of the curriculum corresponding to The Primary Education Stage in Andalusia. In the present work, we present only the results obtained for the 17 items related to the development of Digital Competence. The items obtained a reliability of .88. In order for reliability to be accepted, the value obtained for the reliability of the exploratory research must be greater than or equal to .6, while the confirmatory studies must be between .7 and .8 (Huh, Delorme & Reid, 2006). The domain of each of these competencies was evaluated using a Likert-type scale of ‘1’ (little) to ‘5’ (excellent).

2.4. Statistical procedure
We first carried out a descriptive analysis in order to discover the pupils’ perceptions of their level of Digital Competence and how much time they dedicate to activities related to using the computer, computing, social networks, etc.

We then used the Cronbach’s Alpha to carry out an analysis of the global reliability and individual variances of each
item if this is eliminated. We subsequently carried out an Exploratory Factorial Analysis (EFA) in order to explore the set of latent variables or common factors that would explain the responses to the items on the questionnaire, along with a Confirmatory Factorial Analysis (CFA) in order to specify the number of factors and the factorial weights of each one of them. The data obtained for the aforementioned EFA and CFA were also analysed using the Kaiser Meyer-Olkin (KMO) tests and Bartlett’s test of sphericity, in addition to the Eigenvalues and the common aspects. We also carried out a visual observation of the sedimentation graphics.

We next carried out a Student t test for independent samples with the objective of discovering whether attending extra-curricular computing classes contributed to the acquisition of a greater capacity as regards Digital Competence and also whether there were any differences between boys and girls.

We finally carried out an ANOVA test in order to discover whether the amount of time that the pupils dedicated to the pursuit of computer-related activities allowed them to improve their Digital Competence. The data were codified, analysed and interpreted using the SPSS Statistics statistical software, version 20.

3. Results

Table 1 shows the means (M) obtained for each one of the items of which the questionnaire was formed, and it will be noted that the results are fairly homogeneous. One exception is item (V13), for which the pupils showed a lack of competence as regards solving problems related to the functioning of a computer and which obtained a fairly low value (2.78). However, the item that obtained the highest value of 4.60 was (V5), "I can write texts, compositions, etc. on the computer", followed by item (V7), "I know how to use the calculator that is incorporated into the computer", which obtained a value of 4.57.

We subsequently carried out a descriptive analysis of the variable that shows how long the pupils spend doing computer-related activities: studying, doing work and homework, playing videogames or talking to their friends using social networks, chats, etc. The results obtained show (Table 2) that the majority of the participants (N=182) spend between 0 and 1 hours (58.3%), followed by those who spend between 1 and 2 hours (N=63) with a frequency of 20.2%; 10.9% (N=34) spend between 2 and 3 hours and 6.1% spend between 3 and 4 hours (N=19), while those who spend more than 4 hours suppose 4.5% of the sample (N=14).

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>4.33</td>
<td>1.09</td>
</tr>
<tr>
<td>V2</td>
<td>4.07</td>
<td>1.21</td>
</tr>
<tr>
<td>V3</td>
<td>4.17</td>
<td>1.12</td>
</tr>
<tr>
<td>V4</td>
<td>4.23</td>
<td>1.06</td>
</tr>
<tr>
<td>V5</td>
<td>4.60</td>
<td>.80</td>
</tr>
<tr>
<td>V6</td>
<td>4.32</td>
<td>1.00</td>
</tr>
<tr>
<td>V7</td>
<td>4.57</td>
<td>.92</td>
</tr>
<tr>
<td>V8</td>
<td>3.76</td>
<td>1.36</td>
</tr>
<tr>
<td>V9</td>
<td>4.38</td>
<td>.96</td>
</tr>
<tr>
<td>V10</td>
<td>4.52</td>
<td>.84</td>
</tr>
<tr>
<td>V11</td>
<td>4.18</td>
<td>1.24</td>
</tr>
<tr>
<td>V12</td>
<td>4.36</td>
<td>1.20</td>
</tr>
<tr>
<td>V13</td>
<td>2.78</td>
<td>1.49</td>
</tr>
<tr>
<td>V14</td>
<td>4.38</td>
<td>1.20</td>
</tr>
<tr>
<td>V15</td>
<td>3.59</td>
<td>1.50</td>
</tr>
<tr>
<td>V16</td>
<td>4.06</td>
<td>1.18</td>
</tr>
<tr>
<td>V17</td>
<td>4.07</td>
<td>1.04</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Hours/week</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>182</td>
<td>58.3</td>
</tr>
<tr>
<td>1-2</td>
<td>63</td>
<td>20.2</td>
</tr>
<tr>
<td>2-3</td>
<td>34</td>
<td>10.9</td>
</tr>
<tr>
<td>3-4</td>
<td>19</td>
<td>6.1</td>
</tr>
</tbody>
</table>
3.1. Exploratory and Confirmatory Factorial Analyses

A value close to 1 was obtained for the Kaiser-Meyer-Olkin test for the sample scale (KMO=.901). Moreover, the Bartlett test of sphericity had a level of significance of less than .05, (gl=136; Sig.=.000), signifying that the viability of carrying out a factorial analysis was also confirmed.

The Exploratory Factorial Analysis (EFA) revealed the existence of 3 factors, which the Confirmatory Factorial Analysis (CFA) confirmed, in addition to specifying the factorial weights in each of them. These 3 factors are related to the following dimensions:

a. Dimension 1: Seeking, selecting and organising information.
b. Dimension 2: handling a computer, creating graphics and drawings, and working with images.
c. Dimension 3: Communication and social relationships.

In the first dimension (D1) it is possible to group those pupils who feel very capable when using computers for academic purposes: seeking and selecting information from the Internet, writing texts using specific processors (Word, write, etc.). The second dimension (D2) describes pupils who perceive themselves to be very competent as regards using computers for a more creative purpose: they like to manipulate and exchange photographs, create images, music, etc. and are capable of repairing the computer if it breaks down; the third dimension (D3) refers to those pupils who principally use the computer to relate to and communicate with others using emails and social networks.

Table 3 (below) shows the calculations regarding the reliability of each of these dimensions.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Nº elements</th>
<th>Cronbach's Alpha</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>9</td>
<td>.83</td>
<td>4.3</td>
</tr>
<tr>
<td>D2</td>
<td>5</td>
<td>.73</td>
<td>3.7</td>
</tr>
<tr>
<td>D3</td>
<td>3</td>
<td>.71</td>
<td>4.3</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As will be noted in Table 3, the values obtained show a fairly acceptable internal consistence among the items in each dimension. The highest value is in D1, with .83, followed by D2 (.73) and D3 (.71). With regard to the means (M) of the different groupings of the items on the scale, note that (Graphic 1) D1 and D3 obtained identical values (4.3).

In order to verify whether extra-curricular computing classes contributed towards the pupils acquiring a better level of Digital Competence, we used the Student t test, which provided results showing that the differences in the means between the two groups (pupils who attended extra-curricular computing classes and those who did not) and the results obtained by using the aforementioned analyses illustrate that those pupils who attended extra-curricular computing classes obtained significantly higher scores as regards all the abilities with the exception of one, specifically item (V13), “If the computer breaks down, I can mend it”, (t343=2.133,p<.05).
4. Conclusões

In this study, as has occurred in previous studies (Kennedy, Krause, Judd, Churchward & Gray, 2006; Lenhart, Madden & Hitlin, 2005; Livingstone & Bober, 2004 and Oliver & Goerke, 2007), we have been able to verify that more than 75% of pupils in Primary Education have a good level of abilities in the handling and use of Information and Communication Technologies (ICT) when carrying out tasks related to the academic and social spheres. They feel very competent in activities related to communication and seeking information, which confirms their condition as ‘digital natives’.

We should stress the importance of the relationship between the pupils’ families’ socioeconomic level and their access to ICT, along with the role played by the school environment in that competence (Kuhlmeier & Hemker, 2007). On the one hand we have confirmed Moreno, Guzmán and García’s (2017) findings that the access to technological resources outside the education centre, which is partly a consequence of families’ socioeconomic level, is positively related to pupils’ Digital Competence.

The results of the study consist of a descriptive analysis in which the percentages in the three dimensions analysed are evaluated and which provide valuable information to be taken into consideration in these conclusions. Of the three dimensions analysed, that in which the pupils consider themselves to be least competent is that concerning activities of a graphic or creative nature. Moreover, there are differences between boys and girls, since the boys obtained lower values, unlike that which occurred in the study by Kuhlmeier and Hemker (2007), who showed that boys tend to overvalue the level of their competences. Our results are, nevertheless, similar to those obtained by Aesaert and Braak (2015).

The amount of time that the pupils spend doing computer-related activities, by which we mean tasks related to communication, information and social relationships, is also important (Van Deursen & Van Diepen, 2013). However, the pupils’ use of these means is considered to be ‘rest time’ and rarely are they recognised as a source of learning; they are normally associated with a source of entertainment and leisure, even by the pupils themselves. They identify school with a place of work, effort and learning and the world of computer media as a space for enjoyment and pleasure. Nevertheless, we were able to verify that there is no positive correlation between the amount of time spent using the computer and the development of digital competence, since those pupils who spend between 2 and 3 hours on extra-curricular digital activities school are those who obtained the highest values as regards the development of these skills.

To conclude, it would be advisable to extend the study carried out in Spain as far afield as possible in order to verify the validity of these results in other countries, which would be possible because the subject in question is important for education in general, beyond our geographical frontiers.

**Bibliographic references**


