

## Smartphone functions in photo-elicitation sessions for teachers' continuing professional development

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**Abstract-** In this paper, we advance the results of a study on the use of smartphone functions supported by photo-elicitation processes in the permanent training of primary-school teachers. The study began in January 2015 and will end in December 2017. Three teachers participated from the primary schools Jaime Vera and Concepción Arenal in Madrid and La Paloma in Azuqueca de Henares (Guadalajara), Spain. The smartphone functions used for photo elicitation by these teachers to reflect on the dilemmas and difficulties in their practice include: taking photos of classroom situations that are judged difficult by teachers then viewing these photos. It includes recording an audio track of sessions reflecting on the content of the photos; playing back the recorded audio tracks to transcribe their content. Identifying the theories and beliefs from where participating teachers' decisions are based is another function and, finally, storing and get it back all this information in the cloud (Dropbox, Drive, at the rest). The main goal of this paper is to show how the different applications of smartphones enable teachers' learning as well as their personal and social development through reflection processes of their practices.

**Keywords -** teacher education; photo-elicitation; digital hybrids; smartphones.

### I. INTRODUCTION

This article is an extended version of the paper we presented at eLmL 2016 entitled *The Role of Smartphones in Teacher Training Mediated Through Photo-Elicitation* [1]. We present the work we are carrying through about smartphones in education, related with continuing training of primary education teachers.

Why has our current line of research focussed on this digital tool and not others? Because, beginning in 2015, smartphones became the most common devices for accessing the Internet, compared to other resources such as

the computer [2]. The implementation of mobile phone technology has risen in the last year, meaning it is now available in 96.7% of homes and has become the most common device for getting online, with a growth of 5.9% in its use for the Spanish citizens.

Furthermore, according to Fundación Telefónica's report "The Information Society in Spain" in 2015, Spanish Internet users display the highest adoption rate for mobile devices, with smartphones (82.8%) the most popular, followed by other devices such as tablets (58.9%) and e-readers (37.4%). These figures are higher than those in surrounding countries. Such is the impact of smartphones that, according to the report [3], 90% of users connect every or almost every day to the Internet using this device, and 75% do so several times a day.

The reasons used to explain this increase on its use usually include the features of these digital hybrids. The most essential factors proposed are connectivity and accessibility any time of day, as well as size reduction of these devices. Such features are contributing to the effect that, little by little, smartphones are becoming human digital prosthetic devices. The principal feature guaranteeing success of the smartphone is that they are multi-function devices. In only a few years they have evolved from telephones that only allowed users to call and send SMSs, to devices that can connect us to the Internet so that we can communicate with hundreds of people on social networks, take photos and record videos that are shared in real time with our contacts, offer the possibility of geolocation, commerce, entertainment and so on. The number of options has exploded with mobile applications that are often created by communities of people grouped around an interest. So "the mobile phone is becoming a tool of global communication: via the social networks and with the

extension of Internet access we can communicate worldwide through text, image, sound or video. Such features offer us thousands of applications to make our daily lives easier: information of all kinds, access to content and entertainment, or maps that can find a route to a nearby destination. And all this in the palm of your hand” [4].

These features give smartphones the ability to have a high impact in people’s personal lives. This is true especially in the areas of user communication and socialization. People have gradually modified the way they relate to each other daily by popularising the use of multiple languages of representation, such as audiovisual language. They have even contributed to decreasing face to face interaction in favour of interactions through multiple virtual spaces in real time [5], rapidly and fluidly [6].

“The implementation and social penetration of a new communication technology that has become widely accepted alters and transforms people’s communicative habits. Linked to that, changes occur in the information uses that individuals can make of the new medium. [ ... ] The purposes of communication (communicating, informing, working or dealing with professional matters, entertaining oneself, having fun, training, etc.) converge in the new device.” [7].

For these reasons, in recent years, smartphones have played a key role in communication between people through distinct web environments and, especially, in different applications. Smartphones have encouraged the use of multiple languages of representation where the image is becoming a normal medium that people use to communicate their experiences. Precisely this support for multiple languages or systems of representation is what gives smartphone the potential to have a positive impact in educational processes. In other words, smartphones enable the creation of teaching situations that offer both students and teachers the chance of participating and having experiences; those experiences will guide them towards learning as well as personal and social development.

First, we present the potential of smartphones to create new communication spaces through the multiple languages that users have at their disposal. Second, we analyze the role of smartphones in educational practice, making a review of the most significant work in relation to the topic. Further on, we explain the photo-elicitation as a process that uses photography to communicate life situations and experiences of people, followed by the objectives and method of research, results obtained so far and to finish the conclusions and future work.

## II. SMARTPHONES AS SUPPORT FOR MULTIPLE LANGUAGES OR SYSTEMS OF REPRESENTATION

Texts, audio, photos and videos play an essential role in communication using smartphones. These resources offer many options: recording and editing using multiple applications for the creation of memes that combine image and text, or for producing images in movement, podcasts and video podcasts. The applications specialized in photography such as Flickr and Instagram that are used on these devices are important too.

Meanwhile, these multi-representational communication environments have been increasingly studied in the last decade. A number of terms have been coined, such as *multimedia* communication that focusses attention on the representation media used in human relationships. Jenkins coined the term *multichannel* to refer to the platforms and applications that allow interaction in different forms of representation [8]. In this respect, the use of different languages has increased. For example, the audiovisual messages, due to the combination of several of the smartphone features and the virtual space available, they allow to a single device to capture an image or video, edit it, publish and broadcast it in different places simultaneously (WhatsApp, Facebook, Instagram, YouTube, Flickr, blogs, Wikis and so on). These uses, as seen, lead to new forms of communication and socialisation and have an impact on our projection in virtual collective spaces. More recently we have noticed a big number of detailed studies of these communication spaces. There is a deluge of literature on the role that virtual space plays in interpersonal relationships. In this respect, the term *media ecology* was coined to emphasise the idea that the new technological devices and communicative channels create spaces that determine how people and society interact and act in different areas: medicine and health, administration, transport and so on [9]. These authors understand the relevance of the technological devices in our lives in the way that they interlink our public and private selves.

Based on these ideas, it is important to highlight the studies [10][11] that are centred on the interactions mediated by technology; in those studies take on special relevance the intentions and emotions emerging from the relationships maintained. So the expression *polymedia* spaces was coined, to designate integrated communication environments aimed to discover, and to understand the possibilities that the simultaneous use of diverse environments offer us with the multimodal language to relate through technology. Always taking into account users’ social and emotional dimension. These studies focus on the personal experience of the use of smartphones. They identify the emotional implications that specific communication environments have for users. These environments can combine old practices such as voice calls with the transmission and exchange of productions such as images between users.

These are emotive components that, as we shall see below, are frequent and therefore need to be represented as part of the situations experienced in classrooms and schools. In this sense, images have gained prominence in showing people's subjective experience. In the same way that texts speak to us, images also speak to us of events, people and things, but furthermore, and more importantly, they are capable of generating meanings, the personal interpretations associated to such representations. In short, a picture does not show us the world but different ways of seeing the world. "Man aims to represent the world, not according to the laws of an important truth, but according to the laws that emerge from his own observation and daily experience" [12].

Roland Barthes highlighted the subjective and mainly emotional dimension that still images activate. He is a reference in the communication sphere because he focussed his reflections on the sensations and emotions that a photograph produces [13]. In this sense, the interest of photography does not reside so much in aesthetic beauty as in the composition of the elements that it shows us. Today Barthes' words remain relevant since in our use of smartphones, the individual's gaze becomes increasingly important through the productions that the latter shares on his or her networks compared to the institutional "viewpoint".

In this way, the user's voice gains prominence, increasing the visibility of multiple viewpoints and situations that were traditionally ignored by the established communications media – a question that has been subject to criticism [14]. Because a smartphone is such an everyday object, it can contribute to the cause of literacy that enables people's emancipation, making us all critical receivers and informers.

To achieve such a premise, we must mention the importance in this matter of an education that provides individuals with the technological competencies needed to intervene freely and critically in these virtual environments. Consequently, we point to the importance of a multimodal means of communication where, apart from making use of different media and digital environments, it is crucial that we have the skills needed for these new forms of communication that are important in the Information Society [15]. Since we work with teachers we would especially like to focus on them. Using a smartphone should be something more than just another object people can use to communicate with those around them. How these devices are used requires some reflection, so teaching staff can discover new roles for these devices in teaching while continually improving their work or, in other words, move forward in their professional development. This means that teachers must acquire technological competencies that enable more independent use, as proposed in "UNESCO's AMI curriculum for teachers", that opts for audiovisual and digital training that goes beyond the mere instrumental use of technological

resources [16]. In this way teachers will become capable of making a critical use of the media in their lives and profession, and smartphones will be increasingly present in educational settings to make their initial and continuing training practice more dynamic.

### III. SMARTPHONES IN EDUCATIONAL PRACTICE

Before demanding that the smartphone play a role in teachers' professional development, they have been used by teachers in different teaching situations to help students in the educational processes aimed at their instruction and training in the diverse stages of primary, secondary and university education. These uses come under the heading of the so-called "M-learning" or electronic learning based on mobile devices with wireless connection (smartphone, iPad, PDA, etc.) as part of significant learning in formal and non-formal contexts throughout life [17] [18]. Meanwhile, mobile learning is being defended as a fundamental strategy to easily break the limitations of time and space through the use of free time and ubiquitous learning [19]. Regarding teaching material, of note is the use of mobile devices in the creation and communication of written texts and multimodal narrative stories in the teaching of second and third languages [20].

A milestone in the primary education stage was the "personalized intelligent mobile learning system (PIMS)", developed in 2008 to improve reading skills in students through news texts in English. The results show that reading skills in free time improve while there is a reduction in the cognitive overload during the reading process [21].

On the use of smartphones and other devices for improving communication in secondary education, the studies highlight the use of mobile phones to access content, as well as so students can receive immediate feedback on their learning that can provide them with a positive motivation for continuing the educational process [22]. Furthermore, in this educational stage, smartphones have begun to be used for reflexive learning and so that students become aware of the opportunities for accessing information that is within their reach throughout the day in multiple contexts [23]. In these studies, the learning activities using mobile devices helped students create conceptual maps, videos, photos, comparative tables, activities to complete and so on [24].

Higher education is where we can perhaps find a wider use of smartphones aimed at the induction training of future teachers, the students in Education faculties. They seek to train students so that they can implement the use of mobile devices in diverse subjects [25]. The functionality that university teachers make of smartphones is primarily focussed on using them as a support for virtual platforms or to enhance e-learning services in universities [26]. Furthermore, we see that the main progress in this field is based on teachers creating photographic and video digital

narratives using mobile devices so they can include them in their future methodological strategies [27]. The conclusion of this study group on the use of mobile phones in teaching is that they can substantially help to improve the performance of students since they encourage information search and retrieval processes, without forgetting other fundamental aspects such as the fact that these devices are giving them a voice and the chance to participate in building knowledge in teaching and learning processes. In this sense changes are being generated in basic education.

Yet, in the field of teacher training, smartphones have been used mainly in induction training that is aimed at preparing future teachers in the use of this device for training purposes. The focus here is on teaching the different basic subjects, such as mathematics, social sciences, physical education and so on while, consequently, forgetting about the use of this device for their own continuing training or professional development as a teacher. In this way, with the work we describe in this article, we have begun a fresh line of research using smartphones in photo-elicitation situations aimed at encouraging teachers' reflection on their own practice.

#### IV. THE ROLE OF SMARTPHONES IN TEACHER TRAINING MEDIATED THROUGH PHOTO-ELICITATION

We begin this section by explaining two conceptual elements. Both are essential to understand the functionality of the phones in teacher training. These are: the reflection on own practice, and photo-elicitation as a means of signification.

##### A. Reflecting on teaching practice

Extensive theorising exists on the value of professionals' critical reflection on their own practice in order to improve their work [28][29]. Teachers can be helped to improve their work once they are aware of their beliefs, theories, attitudes, values and so on. To do so, teachers must be "forced" to make these explicit. This occurs because they are questioned about what they do, and this is achieved by reflecting on his practice as a teacher. This reflection is included and is one of the three moments of a loop or cycle of Action Research [30]. Each is made up of a procedure consisting of the three following phases (see Figure 1):

1- Planning the teaching or specifying within a document the aims, cultural content, materials and so on that the teachers are going to work on or will need over a period of time.

2- Executing the plan and recording certain moments of it. The plan must be followed and information must be recorded on what occurred during the process. Because it is difficult to reflect on the action while it is taking place, reflection has to take place afterward. To avoid forgetting things or missing relevant details the action must be recorded.

What technological tools are needed to help teachers record their actions and reflect upon them? Those whose primary function is producing information; in other words, audio recorders and cameras that can be found on one of the current digital hybrid devices: smartphones. We propose that mainly teachers should follow this procedure, taking photos of those moments so that later, outside the classroom, they can verbally analyse the content. Therefore, we focus on the languages of verbal and photographic representation.

3- Analysing, questioning, discussing and reflecting on what happened. After having carried out the plan, one must reflect on the value of what took place; we encapsulate it using photo elicitation, for that reason it is also necessary to use the information reproduction functions that all digital hybrid devices contain. The result of this phase leads to new knowledge on the decisions taken, on the whys or wherefores of the latter and consequently new knowledge of the theories, beliefs and so on that underlie them.

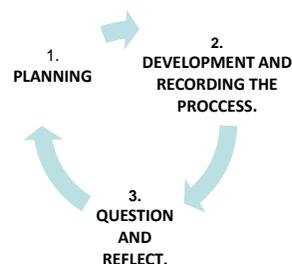


Figure 1. Action-research in the permanent teacher training adapted from Elliot [30].

This generated knowledge gradually enriches or improves the work plan for the following action inquiry loop and consequently enhances the teacher-tutor's training.

##### B. On photo-elicitation as a means of reflection.

Photo-elicitation consists of using photos to communicate people's life experiences. Eliciting means drawing something out of oneself, arousing an experience, establishing a bridge between the past and the present using a photo [31][32]. This is a form of narration where images are used to elicit the thoughts, interpretations and meanings that people place on the actions, objects or events represented in the photos. It aims to capture an image of reality that can be used to see aspects of the image "through the others' eyes", along with particular interpretations that other people have of that image.

This procedure has been used in diverse spheres of social and cultural intervention. For example: as a reflective procedure forming the basis for intervention plans based on the narrations of participating young people with HIV [33];

as a critical practice for social regeneration through community change [34][35][36]; and to promote health in a participative manner [37].

In the teacher training sector, diverse experiences emphasise the value of photo-elicitation for narrating and building the teacher's experiential knowledge. For example, using this procedure, the nature and content of the pedagogical beliefs of sixteen adult educators was explored and compared to their past school experiences [38]. Likewise, it has been used to get teachers to talk about the needs generated when teaching students with autism spectrum disorders [39], and also in teacher induction training to capture classroom situations on camera to illustrate changes in their teaching practices [40]. These studies highlight the reflective nature of photo-elicitation to understand how teachers master new pedagogical approaches and apply them in their teaching practice in the classroom.

In short, the photo-elicitation consists of capturing an image so as to describe it later. Several procedures exist in the field of education: one is that directed by the teacher and the photos she or he takes; another, when students take the pictures, and finally, a mixed procedure where everybody takes photos. This means the photos are taken by users to be screened later so users can describe what they represent and explain what they have experienced.

In this sense, we consider that photo elicitation is a good procedure for understanding the tangible and intangible aspects of human beings' lives – in our case, the three primary school teachers who aim to improve their teaching practice. At the point of reflection within the action inquiry loops, photos taken by the participants are shown (in our case, only the teachers) on different teaching moments as a base document to question, query or wonder about some aspect of the content depicted (see Figure 2).

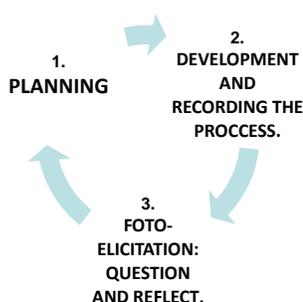


Figure 2. Place of Photo-elicitation in the process of research-action.

This is how we have used one of the underused action inquiry procedures called observational and narrative, McKernan said: that an underdeveloped resource in the conduct of curriculum action inquiry is the use of the still

photograph [41]. Likewise, two aspects that were not considered in prior studies make our research innovative and useful. The first is the incorporation or use of photo-elicitation into action-research loops, specifically in the reflection phase. The second is giving teachers a smartphone so that they can record and analyse the difficulties and dilemmas arising in the classroom and school.

Below we describe the aims and research method used to discover the positive aspects of photo-elicitation situations in action research processes and also the functions required of smartphones in these processes.

## V. AIMS AND RESEARCH METHOD

This research has two objectives:

- a) Identify the functions required on a smartphone in the training of primary teachers based on photo elicitation processes.
- b) Know whether the photo-elicitation sessions help teachers change their teaching practice.

The data needed to achieve the above aims are being gathered through a supported discussion group in two session types we call photo elicitation and audio reflection.

*Photo elicitation sessions.* These are held every two weeks. During this time, the teachers take photos of events, tasks, dilemmas, conflicts, behaviours and so on that they consider most relevant and interesting in the life of their classroom and other spaces in the center. After each fourteen-day period, the above-mentioned meeting takes place. It lasts about 75 minutes with each teacher separately and takes place when they have some free time during the school day in their respective schools. To do so, the photos taken by each teacher are shown and the teacher, the research group members and student representatives comment on the reasons that led her or him to take each photo. Next, the other group members formulate questions or doubts on the content of the images and the reasons provided by the teacher and students, either on the decision taken at a specific classroom moment, or on the tasks undertaken by students, etcetera.

*Audio reflection sessions.* An audio recording is being made of the photo elicitation sessions with a two-fold research purpose. Firstly, to analyze each teacher's statements and respond to the questions posed in the first aim of the project, regarding the different uses of the smartphone. Secondly, to codify and create the information provided in the photo elicitation session to be used in the second aim.

The information analysis was conducted with the help of the NVivo 10 software application. We are using it specifically to incorporate each photograph shown or projected in the photo-elicitation sessions and relate it to the verbal content it evoked. Furthermore, it is being used to establish initial relationships between the text transcriptions of the interviews with participating teachers,

using the *Links* function in NVivo 10. Lastly, we are applying the *Queries* and the *Nodes* functions in that software to define the coding. These queries are guided by the questions and aims of the study. For example, to discover the functions provided by, or required of, smartphones in the process of teacher training in general, and in the photo-elicitation sessions in particular, we conduct text searches for terms such as *advantages, positive impact, uses, utilisation, application, has the function of, helps to, enables or makes possible, save, search, retrieve, view* and so on.

To answer the first research objective, this first analysis has helped us to identify situations (codes) or moments of the photo-elicitation sessions where reference is made to the functionality of smartphones. When we talk about functions of smartphones we refer to the meaning of a Smartphone for teachers in different situations or experiences of use. What we intend with our analysis is to identify all those meanings or functions provided by these experiences of the three teachers. From our point of view, to know these functions we must identify and understand the experiences with these intelligent mobiles that caused them. We understand that the most direct way of knowing these human experiences is to narrate them, rather than to quantify them. This explains that, for us, each situation of photo-elicitation is equivalent to an open interview, that situations do not need a questionnaire, because the questions are oriented from the spontaneous manifestations of the teachers about images of moments in their classrooms.

In the next section we will explain the categories discovered to date in relation to the first aim of the study, focus of this article.

As stated in the summary above, the discussion group that conducted this reflection consists of the teacher who is the center of the training process, the members of the research team who were present during the prior photo elicitation session, and some students when they appear in the photos. The parents gave permission to use the photos where their children appeared as long as such use was confined to teaching and research purposes.

## VI. RESULTS

In order to respond to the first aim, we are working on the content of the photo-elicitation sessions recorded in audio. But furthermore, the observations by many of the members of the research team are focussing on the use that teachers make of smartphones during action-research loops. The significance of these uses observed for each teacher is being compared and validated in formal and informal interviews conducted with them. We then group these results according to the meanings given by teachers and the representation systems used and commented on by them.

A). Global meanings provided on the hybrid nature of these devices, that are a product of the assessments teachers

made in informal and formal interviews conducted at the end of each trimester:

“School teacher 2: The good thing about having a state-of-the-art phone is that you have everything together all the time.

Researcher: What do you mean “everything together”?

School teacher 2: Well, you can take a photo or record what they say, or record a video on how they are working in class or playing in the playground ... Ah! And I can also write a note to explain a photo and send it on WhatsApp so it doesn't slip my mind to talk about it later.” (Interview fragment, 11/3/2016).

“Researcher: How is taking photos and send them to going?

School teacher 3: Quite well. When I have taken photos I'm not worried about sending them because I can do so easily on WhatsApp once I'm home and more relaxed ... The truth is I forgot to send you the photos after the last session because I had a very busy week and I'll send them when things calm down. I have them stored on my phone and can send them straight off.” (Interview fragment, 27/04/2016).

B) Specific functions assigned to and required from smartphones that are the result of observation carried out by researchers in their field work and the statements of participating teachers when asked about their experience with these devices:

- *On taking the photos:*

“Researcher: What were your decision-making processes for taking each of the photos in your classroom? What factors played a role?

School teacher 1: When making the decision to take a photo two types of factor came into play: external and internal:

- External: Events occurred in my environment that needed to be dealt with and solved because they affected classroom organisation. I decided to take a photo when I observed something unusual in the group. If I compiled enough photos it reduced the risk and uncertainty when dealing with these topics.

- Internal: Something clicks inside me and I know that something was happening that required more time and analysis than we currently had available in the classroom to try to solve it. And having this great opportunity, to take photos, I was able to relive these moments later and analyse them more carefully. I could break them down into smaller parts that would let me make more accurate decisions.” (Interview fragment, 14/12/2015).

On the same question the researcher asked above, but asked in later trimesters:

“School teacher 1: I feel calmer when I can save the photos I take in class because I know I will later have time

to think about them and about what is said in meetings. Uploading them to Dropbox so you can see them and help me out reassures me". (Interview fragment, 16/03/2016).

"School teacher 2: When there is something I am not clear about, or I have doubts about something that is happening at school or in my class concerning the relation with the 6<sup>th</sup>-year students, I can see it solves the problem when I take a photo and tell myself: there it is, saved on my phone so I won't forget it and I can send it by WhatsApp to the research group to view it the next time they come." (Interview fragment, 27/05/2016).

"Researcher: Can you comment on "What is it that makes you take a photo?"

School teacher 3: Those things that worry me, that don't go well in class .... Such as, for example, Leire's classmates' rejection of her, so I take the photo ... and as time has passed, well, I see it's working, because they (the students) are fine. This leads me to take the photo to comment on it later, because they are responding." (Interview fragment, 27/03/2016).

"Researcher: Can you comment on what these photo-elicitation sessions have most contributed to your work?"

School teacher 1: These images have helped me to value my time far more as well as the importance of the photos themselves. Being able to view the images taken in class over and over again means I can make much more sensible and suitable decisions regarding the personal situation of each of my students". (Interview fragment, 14/12/2015).

School teacher 3: "I have realised that we do many things and are not aware of the day to day, and that they work ... The change in students, for example. I realised after the sessions with you that I have accomplished things – I have even gotten the families to change... And that makes me feel good, it reassures me". (Interview fragment, 27/06/2016).

Regarding the use of digital image projectors, only one of the three teachers, referred to in the article as teacher 1, preferred to observe the photographs through their projection on a wall screen. The reasons she stated were that in the classroom where the photo-elicitation sessions took place they had a digital projector anchored in the ceiling. Another reason is that she "had a habit of seeing the big picture whenever there was a group meeting, because it was easier and more comfortable to see and discuss its content".

- *On the audio.*

"Researcher: When I arrived during playtime, I saw you in the class wearing your earphones. Do you like to listen to music when you're alone?"

School teacher 2: No, it wasn't music. Since I knew you were coming, I was listening to the recording I have on my

mobile phone of what we talked about last time, about the photos of the playground conflict.

Researcher: Yes, I think that listening to the discussion again helps you to reflect on and draw conclusions from it.

School teacher 2: Yes, but I don't do it just for that, but also to hear myself, to improve my speaking, to avoid repeating certain words too often, to avoid using fillers, that I sometimes use without realising it.

Researcher: Do you always keep the audio recordings on your phone?"

School teacher 2: Yes, mainly because in my phone I have them sorted by date, that helps me to find them easily." (Interview fragment, 27/05/2016).

- *On the texts.*

"Researcher: I see you've added captions to almost all the photos you have taken.

School teacher 1: I like to write notes on the photos so that I don't forget what they mean.

Researcher: In fact, the text helps to define an image's polysemy. Above all, it is necessary when you want to communicate accurately to others what that photo means to you.

School teacher 1: It even helps me personally, because I like to read the transcripts that were made of the conversations during the photo-elicitation sessions stored on Dropbox.

Researcher: To see why we act how we do in class?"

School teacher 1: For many reasons. It's reassuring to read and then re-read slowly what we said. To find out how others see what I do and, strangely, to understand how I think and act without being aware of it. When I read that you are surprised or when you ask me questions, I understand better how sometimes I don't do things so logically or, rather, coherently, such as not being constant..." (Interview fragment, 16/03/2016).

"Researcher: Why do you take a notebook into the photo-elicitation sessions?"

School teacher 3: Because when I take written notes, it helps me to communicate and express what each photo means, the feeling that a specific object, action or situation has for me. In the notebook I write down the feelings that the photo elicits... I realise that I make notes very fast, so fast that I almost can't stop to analyse what is happening in the day to day." (Interview fragment, 27/06/2016).

The above data confirm the positive assessment by teachers of the general functions of accessibility, multimodality, connectivity and so on, indicated in the review of studies we made in the earlier sections of this article. Yet, this reveals a number of specific functions that help to develop the photo-elicitation sessions in the action-research loops. As we will argue in the conclusions, all of the functions related to production, storage and retrieval of information are present in the representation of images,

sound and text. Even so, the three teachers say there is a lack of applications that simplifies taking written notes and storing them on their mobile phone as easily as they take a photo or record an audio file. They compensate this handicap with alternative procedures such as writing a WhatsApp message.

## VII. CONCLUSIONS AND FUTURE WORK

1) Regarding the **first aim**, the functions that the three teachers required of a smartphone are:

A) It can be seen that the teachers assign a number of overall functions to these mobile devices, specifically those that refer to accessibility, their hybrid nature, connectivity and multi-functionality. Overall, operating as a sort of human digital prosthetic device, smartphones are enabling these teachers to store and retrieve information at any place or time. So from the point of view of the digital divide, any material aspect can be reduced by gaining access to digital devices and, through them, information.

B) Specific functions assigned to and required of smartphones:

B1. *Taking photos* of classroom situations that the teachers considered complex and conflictive, such as dilemmas, difficulties arising from the students and so on.

This is the most sought-after smartphone function in photo-elicitation sessions included in action-research loops.

B2. Saving photos on the smartphone or *storing them in the cloud* (Dropbox, Drive, etc.).

We observed that this function is used more or less depending on the teachers' "smartphone literacy". Specifically, School teacher 2 only knew how to store information (images and audio) on her phone and send them by WhatsApp to the group, as long as the files were not too large. She did not know how to store and retrieve information on cloud applications such as Drive or Dropbox. So a degree of technological literacy is needed at the start of photo-elicitation sessions.

B3. *Viewing those photos* in the photo elicitation sessions independent of the existence of a digital projector.

Independently of the existing technological equipment in the school (laptops, interactive digital whiteboards, digital projectors, etc.), teachers and members of the research team were always able to view the photos they had taken on the smartphone screen itself to analyse and discuss any difficult situation or specific dilemma arising in their classes.

B4. *Making audio recordings* of the sessions to reflect on the content of the projected photos, as well as the interviews conducted with participating teachers.

This is a function of smartphones that has provided help not just to teachers to be able to listen again to their statements in photo-elicitation sessions, but also to the research team, to conduct the analysis and create the experiential information provided by participating teachers.

B5. *Uploading the audio files in the cloud* (Dropbox, Drive, etc.).

In contrast to the photos, the audios were recorded by the research group. Firstly they were recorded on a Smartphone and later stored in each centre's Dropbox account, that all participants, teachers and researchers could access.

B6. *Playing the recorded and stored audio files* to transcribe their content and identify the theories and beliefs from where the decisions of the participating teachers are based.

As with the above function, this function was basically used by the research team. However, it is clear from in the information provided during the interviews that the teachers also used this function to listen to themselves again and, as School teacher 2 said, "to improve my speaking, to avoid repeating certain words too often, to avoid using fillers, that I sometimes use without realising it."

B7. *Storing the texts transcribed in the cloud* (Dropbox, Drive, etc.) for later analysis.

This function was only included by the research team because it was responsible for making the text transcripts of the audio recording content.

B8. *Reading the transcripts stored in the cloud*.

Similar to function B6 above, this function was used by the research team *to analyse* the theories, beliefs, attitudes and so on, from where the teachers' behaviours and decisions were based. Once this was established, teachers could be informed and become aware of such habits. At that point, teachers could reflect and assess whether they would change these practices or not, especially those that are not aligned with the ideas and educational principles they defend. But this function was also included by teachers, to carefully read the content of the transcripts and "understand how [they] think and act without being aware of it".

This second group of features, the specific ones assigned to or required of smartphones, enables us to tackle the functional dimension of the digital divide because they allow teachers to build knowledge using the stored information to reflect and discuss their teaching practices in classrooms and schools. So teachers, as well as being users of the information, are becoming producers of knowledge on their professional teaching practice.

2) Concerning the study's **second aim**, based on the results as of late June 2016, it can be stated that teachers are changing the way they design and approach teaching situations. This is because, according to the analysis of the transcriptions of the photo elicitation sessions, the teachers are becoming aware that they base their actions and decisions on five different aspects of their person:

-Theories: rational ideas or arguments, with a scientific basis.

-Beliefs: ideas or arguments with no scientific basis.

-Attitudes: forms or kinds of willingness to do or respond to something.

-Habits: routines they use in certain situations.

-Emotions: feelings about a situation that guide decisions.

The teachers have shown a disposition to change once they become aware that the above five components influence their motivations and decisions, both to improve the school tasks in the classroom and to address the personal difficulties of their students.

Finally, we should indicate that all of the smartphone functions that the teaching staff required in the discussion or photo elicitation processes (those that take place when viewing the image of a photo taken by the teacher and projected on-screen) were used to record moments in the classroom, to bring some quietness to the educational practice in order to slow down the analytical processes. These pauses made it possible to describe and interpret the content reported by the participating teachers, allowing them to reflect and comment on their theories, beliefs, attitudes, habits and emotions so that, once aware of them, the teachers uncovered those that are incongruous with their idea of education or unsuitable for working with that unique and unrepeatable group of students in a specific context.

In the future, we want to deepen the possibilities for smartphones to locate, select and project a part or element of a photograph. We think that the analysis of these details of an image can help teachers to evoke their theories and beliefs. Also, we want to use smartphones to store and play music during sessions photoelicitación. We think that both, the projection of detail and background music, can improve the evocation of the beliefs and emotions that have promoted the decisions taken in their classrooms.

We cannot conclude this article without referring to an ethical aspect of continuing professional development. The teachers come to these professional development sessions with very different training or skills in the use and application of smartphones in general, and in education in particular. This leads us to believe that certain minimum digital skills training on smartphones is needed in the future to enable teachers to store and access information and produce knowledge. It is basic training in a subject we have called *smartphone literacy*.

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