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Metrics of Informational Competencies in the Higher Education in the Context of Mobile Learning

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Metrics of Informational Competencies in the Higher Education in the Context of Mobile Learning

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Abstract

The introduction of mobile technologies in the higher education field has entailed a new way of approaching, searching and relating to information. Therefore, it appears as a priority to carry out a diagnosis of the new teaching-learning environment, in which mobile devices stand out as fundamental components. To this end, two quantitative instruments have been compiled and validated to measure the relationship between the use of mobile devices for learning, the informational competencies possessed by the actors involved in the learning-teaching process and their attitudes towards the new paradigm of education. The questionnaires MOBILE-APP (addressed to teachers) and MOBILE-APPS (addressed to students) have been prepared taking into account the following pillars: 1. A prior diagnosis of the needs of the university students of the field of Social Sciences through the use of the Focus Groups technique, 2. The reference framework of the ACRL, 3. The dynamic and changing nature of mobile technologies. For the validation of these instruments, a pilot study was carried out on an intentional random sample of students (N = 105) and teachers (N = 43). To this sample, in addition to the questionnaire, a rubric was provided to evaluate the different aspects of the questionnaire, from sociodemographic data and the different dimensions that comprise it, to the understanding of each of the items. Simultaneously to this pilot study, a experts judgment was carried out. The questionnaire was sent to professionals of higher education and international researchers, whose observations allowed to redefine the design of the questionnaire. After studying the results obtained with the two previous techniques, with which the high internal consistency of the tools was demonstrated, a final review of the questionnaires was carried out that resulted in the redefinition of some items to adapt them to reality of the context that is the object of study. We can conclude that two useful tools have been developed, which are easy to apply to diverse contexts and it is capable in turn of being revised to be adapted to the changes that could take place in the higher education and related to the mobile technologies. As a future project, we consider applying these instruments to develop educational models that facilitate the learning of university students, complementing the formal education they receive in the classrooms.

Introduction

The development of the information and communication technologies, mainly mobile devices, has resulted in new unexpected attitudes in the educational contexts. In this case, we cannot forget that mobile devices have become an easy way of connecting, regardless of the place and with the immediacy and the effortless mainly required by the new generations. Due to a number of reasons, we could reflect of the influence this new stage has exerts on the access to the information, and as a consequence, on the concept of Information Literacy itself. In any case, it is relevant to underscore that the technologies of the information and the communication, in this case, mobile technologies have turned into an unstoppable process. They have established a strong foothold in our society, and, in turn, they are becoming a priority for the development of the process of learning and teaching in the context of the higher education institutions.

The concept of information literacy is experiencing a process of change, since the access to the information is unavoidably linked to ubiquity and immediacy. That is why we cannot forget that the new ways of personal relations and interrelations with the information are in constant process of evolution and subject to the information and communication technologies. Due to a number of endogenous and exogenous factors, in the context of the current superior education and the era of the mobile technologies, it becomes a priority the acquisition and development of skills related to the information management, what is to say, research, assessment and the processing of information and communication. We must not forget that the university students need to acquire informational competences to develop a necessary critical thinking. Information Literacy is the foundation of the long-life learning, due to it enables students-future professionals- in any stage, in order to search, assess, use and generate information.

If we take into account the university students, we cannot forget that most of them belong to the so-called *millennial generation, net generation, or generation Z* (Reese Bomhold, 2013; Mohr, 2017), also considered as the "instant generation" (Loveland, 2017, p. 34), or even the *google generation* (Fawley & Krysak, 2012; Mihailidis, 2014). This new generation usually employs the social nets and diverse mobile applications in their daily lives. This fact has, without any shadow of doubt, many advantages. In any case, we cannot deny that it also finds some disadvantages we should take into account:

1. Difficulties to distinguish between academic and personal spaces.
2. Constant use of devices.
3. Lack of a critical attitude towards information, including the academic information they need for the university context (in the case of university students); and also to face all the news they access through the mobile devices they own (Alhassan, 2016).

In the framework of the project we take part in, *Innovation and training Information Competences of University teachers and studies in the Social Sciences*, we have developed a double instrument, for teachers and students, and in order to measure perceptions on the Information Literacy levels. This turns into a priority to understand the current situation, and to know how to implement measures and strategies to optimize the use of resources and devices to improve attitudes towards information, sources and devices.

For this purpose, two questionnaires were produced, validated and now they are currently in the implementation stage.

The main purpose of this work is to make known both tools, in order to underscore its utility, innovative character, and the possibility to be applied to many contexts and situations in the higher education institutions. The goal of both questionnaires is to carry out a diagnosis about the perceptions concerning to the levels of Information Literacy in teachers and students, and the attitudes towards the information itself and the mobile technologies:

a) The *MOBILE APP (**Mob**ile – **I**nformation – **L**iteracy – **E**ducation – **A**ttitudes – **P**erceptions - **P**rospectings – **P**rofessors* has been designed for University teachers.
b) *The MOBILE APPS (**Mob**ile – **I**nformation – **L**iteracy – **E**ducation – **A**ttitudes – **P**erceptions - **P**rospectings - **S**tudents*) is the version for students, specifically conceived for this heterogeneous collective of the University community.

Other objectives we take into account are the following:

1. To describe the advantages and the scope of both instruments.
2. To explain the main features (dimensions, factors and ítems) of the questionnaires.
3. To show the validity and the internal consistency.
4. To establish their applicability, on the basis of their originality and utility.

Literature Review

On the basis of the processes of changes experienced by the society, mainly during the last two decades, we must underscore that the most significant changes have taken place from 2012, thanks to the generalization in the use of the mobile devices. However, the paradigm shift started some years before. The easy access to the internet, and the possibilities offered by the diverse internet search engines, and the databases started materializing, almost twenty years ago. That is why Alexander (2004), after he had analyzed the initiating paradigm shift, coined the term "nomadic learners" (p 28) to anticipate the posterior situation for the learning environments, concerning to the essential change of attitudes towards access and information management.

Figure 1. *Acces to Information*
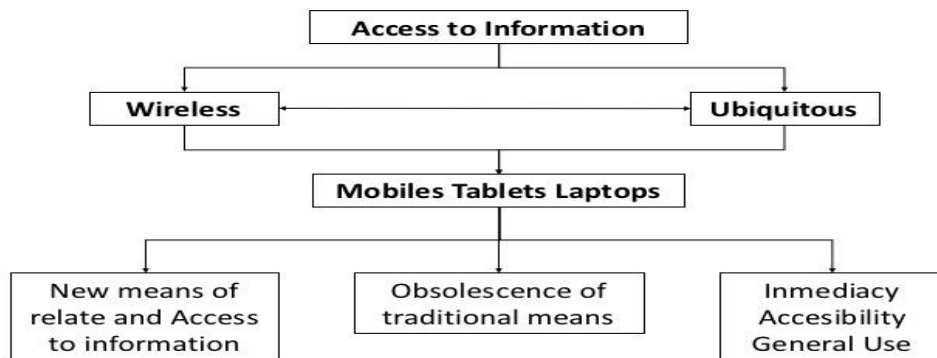
Source: Prepared by the authors on the basis of data by Alexander (2006), Shih (2007); Knobel and Lankshear (2007)

There is a growing interest in analyzing the new ways of relation with the information, the attitudes and the self-perception on the information literacy, the authorship and the critical attitudes towards the diverse source of information, in the context of an increasingly easy access to the different resources. In this vein, the progressive transformation of the information literacy into digital and later, mobile literacy, has exerted a deep influence in the educational contexts, in this case, within the framework of the higher education institutions (Goodfellow, 2011). We cannot deny that mobility, ubiquity and independence are linked to the immediacy and diverse possibilities offered by mobile devices (Pegrum, Oakley and Faulkner, 2013). This situation is described by Rossing, Miller, Cecil and Stamper (2012), who underscore the unstoppable process of introduction and development of mobile devices in the learning and teaching practice. This situation implies very positive aspect, but also, many disadvantages, like the lack of critical attitudes, the difficulties to distinguish between reliable and manipulated information, and even, the generation gap. This last aspect, focused of the generation divide, is particularly visible in the case of the relations between students and teachers, concerning to the way in which they relate to the information, and the mobile technologies as well. In this same vein, Friemel (2016) in his quantitative study underscores that generation divergences are directly related to the age. That is why the author coins the term *grey divide* to point out that the discrepancies in the acquisition and development of the digital and mobile skills increase in people over 65 years, despite this factor seems to be conditioned by other circumstances: gender, occupation, previous activity and even the interest itself. It is crucial to take into account this aspect we have just describe, because it can help us to understand the generation gap sometimes very present in the academic relations between teachers and students.

In any case, Havelka (2013), in her descriptive research, considered that the mobile literacy and the integration of these devices in the processes of learning and teaching, although it is an unstoppably growing process, it is still in its first stage, in a real *technological childhood.* Nevertheless, we can affirm, based on direct observation that this initial situation has radically changed in few years. And Walker, Rosenblatt, y McMahon (2015) stand for the normalization of the use of the mobile devices in the higher education contexts. Moreover, Bouhnik y Deshen (2014) also consider the devices as an interesting tool to make easier the communication between students and their teachers. In any case, the use of devices is not directly linked to the informational skills. We should take into account that the basic information literacy competences (search, research, analyze, value and interpret) are required for university students, in spite of the process of acquiring them, they must start being acquired before, in order to be developed in a correct way (Weiner, 2014). In any case, it is not possible to renounce to the new teaching and learning spaces, including the consideration of the reality conceived like the integration of virtual spaces. The *infosphere* has considerably transformed the relations between teachers and students, and also, the way or relating to the information itself, adding a number of advantages, and of boundaries to the knowledge as well (Floridi, 2014). In this same vein, Filbert (2016) considers as crucial the role of professionals of the information and communication, including of course teachers and educators, in the acquisition of the information literacy and the correct and rational use of mobile devices to develop them. Thus, Bosman & Strydom (2016) underline the relevance of a potential critical attitude on the mobile literacy. It becomes a priority to increase the awareness and sensitiveness of the use of the devices, to fulfill expectations on the development of the information literacy. Neither must we forget the social-emotional and pedagogical implications that the paradigm shift implies for the development of these processes in the context of the higher education. That is why Al-Emran, Elsherif y Shaalan (2016), in their

quantitative analysis, after they had checked there were significant differences in the use of mobile devices according to the age, they underline the possibilities for the access to the information which these devices offer to the university community. However, they highlight that the age is not unique conditioning factor for the acquisition of mobile skills: ownership, familiarity with devices and backgrounds also exert a relevant influence on the mobile information literacy. From a similar perspective, Moreira, Ferreira, Santos, & Durão (2017) carried out both a quantitative and a qualitative study on the university students and their attitudes towards mobile devices and literacy skills. They concluded the development and generalization of the use of mobile devices in these contexts contributes to increase the opportunities and also to decrease the differences. It is, in turn, a privileged means to access and to disseminate the information and to extend the process of learnig and teaching beyond the classrooms. Likewise, Pechenkina et Al. (2017) insist on this point of view, and also underscores the growing relevance of the diverse apps that are being developed by a number of higher education institutions. This perspective is also shared by Kuzmisnka et Al. (2018) who points out that there are divergences even in young people. They underline the relevance of acquiring the digital competence in the mobile age, mainly for teachers, due to the increasing generation gap. The also consider that mobile information literacy and school achievement are unavoidably linked. Greenhow and Lewin (2016) refer the concept of *digital cultures*. Although this concept is represented nowadays by the mobile or ubiquitous culture, the basis of this element is the idea of the *connectivism*. We cannot forget that basic and classic literacy skills are currently developed through the diverse *connected* devices, mainly mobiles. As a matter of fact, all the possible literacies are closely interconnected and mutually reinforcing (Pegrum, 2016).

In a similar vein, Hwuang et Al. (2018) conducted a quantitative analysis of university students about their perception in the use of mobile device in the context of higher education. The concluded that the use of these devices turns into a privileged means to acquire necessary skills, based on a critical attitudes and thinking and also to communicate.

Methodology

In order to elaborate the questionnaires MOBILE-APP (addressed to teachers) and MOBILE-APPS (addressed to students) we took into account a number of elements, derived from the direct observation and the interactions with students and professor at our different university institutions:

1. The unstoppable process of generalization of mobile devices in our societies, mainly among young people.
2. A prior diagnosis of the needs of the university students of the field of Social Sciences through the use of the Focus Groups technique.
3. The reference framework of the ACRL.
4. The attitudes of university students towards information.
5. Related to the previous one, we observed the level and difficulties of students to develop the required information skills.

To develop both questionnaires the *ad hoc* technique was employed as the main means of collecting data. Moreover, we took into account the following aspects and procedures:

1. The growing increase of the mobile technologies in the higher education institutions.
2. The unstoppable and constant changes, both in devices and applications.
3. The unavoidably relations between information skills and the use on technologies.
4. The awareness and sensitiveness of the generation gap, between students and teachers.
5. Students´ abstraction and *infoxication* or *infosaturation*.
6. The lack of critical attitudes towards information.

We must underscore the concerns of teachers for progressive decrease of the information skills in their students. This reality can be also applied to the general society. In this vein and due to the generation changes as well, we can find a wide range of opinions on the use of mobile devices and specific applications for academic purposes. It seems to be evident that immediacy and ubiquity offer a number of advantages. However they imply disadvantages, and it turns into a priority to measure some relevant aspects, related both to information literacy and digital or mobile technologies:

- Relevance of literacy skills.
- Importance of the sources.
- Ability to distinguish the quality of the information.
- The increasing use of mobile in the classrooms.
- The perceptions of digital literacy.
- The authorship.

We also reviewed several previous instruments to develop these questionnaires:

Table 1. *Questionnaires Reviewed*

Autor	Name of the instrument	Year
Uzunboylu &Ozdamli	Teacher perception for m-learning: scale development and teachers' perceptions.	2011
Ng	Can we teach digital natives digital literacy?	2012
Yang	Understanding undergraduate students' adoption of mobile learning model: A perspective of the extended UTAUT2.	2013
Lai, & Hwang	Effects of mobile learning time on students' conception of collaboration, communication, complex problem–solving, meta–cognitive awareness and creativity.	2014
Koc & Barut	Development and validation of New Media Literacy Scale (NMLS)	2016
Aharony, & Gur	The relationships between personality, perceptual, cognitive and technological variables and students' level of information literacy.	2017

Source: Own-elaboration (compilation based on the literature review and analysis)

Some tests were conducted to develop the definitive instrument. These can be considered as the starting for the posterior development of the *MOBILE-APPS* and the *MOBILE-APP* (the instruments for student and for teachers respectively).

As we have previously pointed out, several conditioning factor were taken into account to develop both questionnaires. Moreover, after we had reviewed several instruments and many publications, we tried to innovate by combining two key aspects: learning methodology and the acquisition of informational skills. In the previous questionnaires we had analyzed and consider we could find one of these aspects, but never their combination. In addition, these questionnaires

can be useful for a wide range of university contexts, and it is also adaptable to the continuous changes that the technologies experience in a short period of time. The rapid emergence of new devices leads to a quick obsolescence we should not forget. That is why we have designed both general dimensions and items to adapt to new contexts and to have a diachronic projection.

After several trials and revisions, we implemented and validated the questionnaires with a selected sample of teachers and students belonging to the last year of the university degree (intentional non-probabilistic sample).

We considered both the content and the external aspects:

- We tried to determine if the items were able to measure teacher´s perceptions on the use of mobile technologies in the process of teaching and learning.
- It was crucial to relate the previous aspect to the measure of the informational skills.
- It was necessary to check if the items were congruent and accurate for their respective dimensions.

To validate the questionnaires we designed, on the one hand, an evaluation rubric. On the other hand, some statistical analyses were carried out (inter-item) and we calculate the Cronbach Alpha and the latent structures, through a factorial analysis, applied to the pilot sample (Afthanorhan, 2013).

Concerning to the qualitative analysis of the rubric, in order to measure the clarity and accuracy of the personal information and instructions, we took into account the elements in *Table 2*. All the elements obtained high scores (over 4.23 of 5). This indicates that, as far as the experts are concerned, instructions and personal data are correct, accurate and easy to be understood.

Table 2. *Qualitative analysis. Personal data and instructions*

Personal Data	General instructions
They are easy to understand	It is clear and direct
The ítems are congruent	They are easy to understand
We can find enough items	The information is complete
They respect privacy	

On the basis of a Likert scale (1-5) (1. Very low, 2. Low, 3. Medium, 4. High, 5. Excellent) all the questions scored over 4.10 in this case. That is why we can confirm the general quality of both questionnaires, as it is stated in *Table 3*.

We also included recommendations and improvement measures suggested by experts and the selected students for the final version of the questionnaires.

Concerning to the internal consistency of the instruments, reflected in the Cronbach Alpha they reached, we must underscore the following:

1. The *MOBILE-APP* questionnaire got the 0.816.
2. The *MOBILE-APS* questionnaire reached the 0.851.

In both cases we must underscore a high level of reliability and internal consistency (Gliem and Gliem, 2003).

Table 3. *Qualitative Analysis*

Quality and general coherence
There is an internal congruency among all the items
The ítems are clear and easy to understand
The dimensions are adequate
It is a useful tool
It is original and innovative
We can consider the instruments as clear
General quality
The ítems are not reiterative

Results: The *Mobile-App* And The *Mobile-Aps* Questionnaires

We must underscore that both instruments are linked and they can be also used separately, depending on the goals of the particular research. In any case, they are adapted to the group at which it is targeted (teachers of students, in this case).

As we have previously mentioned, these questionnaires combine several relevant aspects to take into account to measure perceptions on information literacy, the perceptions on the use of mobile technologies and the level of information literacy both at a personal level an at the university institutions.

Despite both instruments have being conceived and developed like a unit, and they show evident similarities, we must underscore they have also divergences we would like to emphasize:

1. The dimensions. The two questionnaires overlap in four ones. In any case, the teachers´ instrument show one more dimension, considered as needed to be measured in the case of teachers.
2. The number of items. In the case of the *MOBILE-APP*, the instrument contents 33 items. On the contrary, the *MOBILE-APPS* is composed by 22 items. The teachers´ point of view tends to be wider, and, in turn, students are not very receptive to answer very long questionnaires. That is why the number of items has been considered optimal in this case.
3. The exact wording of the items is adapted to the specific sector and it is not the same if they are aimed at teachers, or it they are to measure students´ attitudes or perceptions.

Table 4. *Dimensions contained in the two questionnaires*

MOBILE-APP	MOBILE-APPS
1. Informationally literate university	1. Informationally literate university
2. Informationally literate person	2. Informationally literate person
3. Research, analysis, authorship, and processes of construction of the knowledge	3. Research, analysis, authorship, and processes of construction of the knowledge
4. Use of the mobile technologies and resources in the teaching process	4. ICT (Information and Communication Technologies) and students
5. ICT (Information and Communication Technologies) and students	-------

We will explain now each of the different factors that composes both questionnaires.

1) *Informationally Literate University*

This is a common factor for the two questionnaires. It is the focus of the informational competence and its goal is based on measuring this variable both in teachers and in students. Through the analysis if this dimension we try to get an analytical description about what self-perception implies in the collectives we analyze, and, in turn, about the conception of the informationally literate university. The items that compose this dimension reflect in which exert the access to the information increase or decrease in every case. It is also crucial for this factor the results of the processes of teaching and learning and the role of the university in the acquisition of the information skills.

2) *Informationally Literate Person*

On the basis of the previous dimension, this factor is focused on the vision that both students and teachers have about the features and attitudes an informationally literate person has and the necessary skills for this.

3) *Research, Analysis, Authorship, and Processes of Construction of the Knowledge*

The third dimension developed in both instruments is focused on getting information about relevant aspects related to the access, processing and creation of the information itself. It is also related to significant elements like the authorship and the construction of the knowledge.

4) *Use of the Mobile Technologies and Resources in the Teaching Process (exclusively in the MOBILE-APP questionnaire)*

This factor is exclusively developed in the instrument designed for teachers. It is focused on the use of the mobile technologies in the teaching and learning process, the use of resources to make easier the access and creation of the information; and it is also conceived to ease the use of the technologies of the information and communication to invigorate and increase the attractiveness of the lessons. Similarly, we try to study in which exert the teaching activity has experienced an unavoidable change due to the influence of the use of the information technologies.

5) ICT and Students (MOBILE-APPS: 4º dimension/ MOBILE-APP: 5º dimension)

This factor is mainly base on the relation between information technologies and students. We take into account, in this case, the own students´ point of view and their perceptions on the role of teachers in this regard. It also contributes to analyze the self-perception that students have on their attitudes towards these information technologies. This dimension is also useful to measure if the use of technologies has a significant influence in the learning and teaching process, and if this is beneficial or whether it is harmful for the higher education institutions.

Conclusions

On the one hand, it is a real fact that the generalization on the mobile technologies can be considered as unstoppable, and, in turn, it is becoming a conditioning factor it the contexts of the diverse processes of teaching and learning. In this sense, the higher education institutions must adapt to the new tendencies, characterized by immediacy and ubiquity. On the other hand, both teachers and students must be adapted to the new context. Otherwise, the generation gap can increase and the perspectives and points of views may be affected in a negative sense. The new teaching and learning environment, strongly influenced by the mobile technologies has considerably changed the new vision emerging of the university that combines the traditional interest and necessary key skills with the technological means, available to students and to teacher as well. That is why the mobile devices stand out as fundamental components to learn, teach and also to access to the required information.

In order to measure perceptions on the access, selection and use of information, we have developed two instruments, based on information literacy and university; information literacy and students/teachers; research analysis and construction of the knowledge; use of resources; and, finally, the implementation of the mobile devices in the higher education and the perception of its consequences.

After we have validated and, partially implemented both instruments, we must highlight:

1. These questionnaires offer an innovative perspective on the mobile information literacy, due to they measure the perceptions and attitudes on informational skills in the context of the new learning and teaching environments.
2. Despite they are related, both questionnaires are independent and accurate for the purpose the follow.
3. We counted on the collaboration of experts to develop and implement these instruments.
4. They are based on the following aspects
   a. A previous diagnosis of the needs.
   b. We took into account the framework of the ACRL.
   c. It was also considered the dynamism of the mobile technologies and the need of getting used to the development of new applications and devices.
5. They take into account advantages and disadvantages of the mobile devices in the development of these processes. Moreover, it is easy, through both instruments, to establish the differences and convergences between teachers and students, and the

perceptions they have of the implementation of these technologies as an unavoidable process.

6. After we have tested and validated these instruments, we must conclude that they have a very high level of internal consistency. The sequential validation, in two steps, consolidated the reliability and its high internal consistency. The factorial structure in turn, is in line with the structure of the instrument in both cases.

7. Although the questionnaires we conceived for university students of social science, they can be applied to a number of diverse university degrees. These instruments are also easy to be revised and to be adapted to the changes that the mobile technologies and the applications constantly experience.

Thanks to these questionnaires we can have a complete picture of the reality of the mobile information literacy in the context of the higher education institutions, mainly in the social sciences degrees. This is crucial in order to analyze tendencies and future perspectives on the information literacy and development of devices and critical attitudes in future professionals.

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