MOBILE-APPS Questionnaire: Developing and validating a scale to measure the attitudes and perceptions of undergraduate students on mobile information literacy

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Abstract: This paper aims at reflecting on the process of developing and validating a scale for measuring the students' attitudes and perceptions regarding the use of mobile technologies in the teaching-learning of information competencies (MOBILE-APPS). Validation was carried out by administering the questionnaire to a pilot group of students, selected from Education degree, with a rubric to analyse the quality/coherence, clarity and usefulness of the content. The questionnaire was then piloted with a larger sample of students. To analyse the tool's reliability and internal validity, scale validation techniques and exploratory factorial analysis were used. The resulting questionnaire, MOBILE-APPS, is a simple yet effective scale for collecting information. It can be applied in a number of university settings and degrees to ascertain student attitudes and perceptions of mobile information literacy.

Keywords: questionnaire, students validation, mobile technologies, attitudes, perceptions, information competencies, mobile information literacy

1. Introduction

In today's higher education setting during the information and technology era, teaching the competencies for managing information—in other words, finding, evaluating, processing and communicating information—requires increasing levels of attention. The Information Literacy paradigm plays a key role in developing education initiatives and programs that establish the foundation for the information competencies that must accompany students throughout their education. The aim is to teach critical thinking, which is essential for any professional profile after graduation. Information literacy is the basis for lifelong learning because it empowers students—future professionals—in any scenario, to find, evaluate, use and create information whenever needed. In this sense, the revised definition of CILIP Information Literacy Group (2018) is highly clarifying: "Information literacy is the ability to think critically

and make balanced judgments about any information we find and use. It empowers us as citizens to reach and express informed views and to engage fully with society. (…) Information literacy is associated and overlaps with other literacies, including specifically digital literacy, academic literacy and media literacy. It is not a stand-alone concept, and is aligned with other areas of knowledge and understanding". This comprehensive definition puts forward the metaliteracy view on Information Literacy that is also emphasized by the *Framework for Information Literacy in Higher Education* (ACRL, 2015).

This is much more pressing and necessary today because students are millennials or digital natives (Rossing et al., 2012), members of the Google generation (Kiviluoto, 2015: 308), who use social media and mobile applications, which are integrated in their everyday life, without clearly differentiating academic and personal spaces, and constantly using information technology, sometimes without critical thinking or training. For this generation, technology is something natural and a constant presence. A recent report in Spain (Fundación Telefónica, 2017) found a very revealing fact: young people between the ages of 15 and 24 years define themselves as mobile first or even mobile only, meaning that they only manage and consume information on their smartphones.

Within the framework of the research project "Innovation and training in the information competencies of university teachers and students in Social Sciences. Model for the development of programs in the mobile environment," and with regard to the phase for diagnosing the perceptions of information literacy levels in teachers and students, this project focuses on describing the process of validating the MOBILE-APPS questionnaire for measuring the *Students' perception regarding the importance of using mobile technologies in the teaching-learning of information competencies* (***Mob**ile – **I**nformation – **L**iteracy – **E**ducation – **A**ttitudes –**P**erceptions - **P**rospectings - **S**tudents*).

The specific objectives of this study are:

1. To describe the design of the MOBILE-APPS online questionnaire with which to measure students' attitudes and perceptions regarding the use of mobile technologies in teaching-learning information competencies.

2. To analyse the validity and consistency of the questionnaire.

3. To establish the tool's applicability based on its originality and usefulness.

2. Literature review

To answer this question, we used 2009 as the reference point to begin the literature review since no prior studies were found on tools lined to the use of mobile technologies in the process of teaching-learning information competencies. Similarly, it must be taken into consideration that this last decade is when the use of smartphones has become commonplace in teaching-learning settings, particularly in higher education.

In relation to prior studies and tools, we must first consider the proposal by Kallaya, Prasong and Kittima (2009). Its innovative nature was based primarily on accepting that smartphones form part of the teaching process and the various opinions about this. To do so, they presented a tool's validation that may be considered a starting point within the early stages of m-learning (mobile learning). The study by Wang, Wu and Wang (2009) was positioned similarly, with a specific analysis of the situation within higher education. The authors took into account the integration of smartphones in the teaching and learning process, along with the acceptance of those devices. Additionally, a quantitative analysis considered other potential factors for differences, such as gender and age. The tool developed by Al-Fahad (2009) was positioned along similar lines, although it was in the very early stages of mobile integration in higher education. Also, this tool was made available to a very limited sample that only consisted of women because the aim was to analyse the gender variable in a setting where there are major differences between men and women in terms of their access to ICTs and education. In any case, both tools are some of the first to analyse the use of mobile devices in university classrooms and student perceptions of this purpose.

Another leading tool for analysing information competencies is IL-HUMASS (Pinto, 2009). This questionnaire was developed to analyse the following four macro-competencies in Humanities and Social Sciences university students: searching for information, evaluating, processing and communicating-distributing. Although IL-HUMASS does not directly address mobile devices, it falls within digital competency and technology in general.

In the location-specific setting of university students in Jordan, Khwaileh and AlJarrah (2010) piloted a questionnaire on an undergraduate and graduate level to analyse attitudes about the use of mobile devices in terms of their degree of acceptance in classrooms. The authors confirmed how, in the early stages of integrating mobile devices in teaching and learning processes, students showed growing interest and viewed

devices as tools that were increasingly inherent to higher education settings. However, this tool is not centered on IL and omits student perceptions of teachers and how they implement the use of mobile devices in education.

From a qualitative perspective, Woodcock, Middleton and Nortcliffe (2012) carried out a study on implementing the use of mobile devices, installing and using mobile applications for educational purposes in higher education, and the benefits they offer. It confirmed that the gradual growth of their use is proportional to their acceptance, and highlighted certain limitations and the fact that a student segment is opposed to its use for academic purposes. The tool used in this study is based on a qualitative methodology and in-depth interviews, so it can be viewed as one of the few questionnaires of this type to be applied to mobile learning (m-learning).

Subsequently, Yang (2013) performed a quantitative analysis on the use and social influence of mobile devices with relation to the teaching and learning processes in universities. The model set out by the author assumes, through complexity, that when students use smartphones, their intent is based more on *hedonism* (personal use that entails satisfaction, such as communication between equals) than on academic purposes. However, this does not decrease the importance and growing potential of mobile learning. It also analyses the drawbacks resulting from distractions or the lack of critical attitudes towards information.

Vázquez-Cano (2014) also focuses on online learning and the use of mobile devices in university settings. His main objective is to analyse student attitudes of mobile learning through the use of a quantitative scale.

Su and Cheng (2015) go one step further with their questionnaire, which takes into consideration other factors such as motivation, its relationship with gamification, and achievements as well as results, in addition to the growing use and exponential growth of apps, and the possibilities they offer to ubiquitous learning.

Pinto and Fernández-Pascual (2014; 2016) used the EVAL-CI questionnaire to analyse the beliefs of Humanities and Social Sciences students in Spain regarding the relevance and self-efficacy in information competencies and skills, highlighting the existence of a low self-perception in terms of efficacy, the growing use of mobile devices in academic settings and the need to delve further in this direction.

Lastly, it is worth noting that the design of the MOBILE-APPS questionnaire took into account the Framework for Information Literacy for Higher Education (ACRL, 2015), which is an undisputed example for reflecting on and rethinking IL education today, in addition to the tool piloted by Sharma, Sarrab and Al-Shihi (2017), which measures the acceptance and generalization in the use of smartphones as an increasingly essential medium for accessing information, interacting, creating new resources and sharing knowledge. To do so, the authors considered a model made up of six factors: flexibility, adaptability, enjoyment, efficacy, economy and sociability.

3. Designing the MOBILE-APPS questionnaire

3.1. Phases

Based on the existing tools that gave growing importance to the general use of mobile devices in the teaching-learning processes of higher education, several factors were considered when creating and piloting the MOBILE-APPS questionnaire. Firstly, the aim was to build an original tool, in a simple and applicable manner, which combined these three concepts: higher education, smartphones and acquiring information competencies. Secondly, the goal was to design an attainable tool since the complexity or length of certain tools often discourages students from participating in studies spontaneously and willingly. As a result, efforts were made to create a simple yet effective questionnaire for collecting information that could be applied in an array of university settings and degrees. Thirdly, it was taken into account that the tool should adjust to two interrelated aspects: the undisputed presence of smartphones in today's society (current situation) and the fast evolution of devices (changing adaptability situation).

To create the tool, the following aspects were also considered and directly formed part of the decision making process:

1. In the first phase, tools that had already been validated were reviewed, including some of our own. Specifically, the IL-HUMASS and EVAL-CI questionnaires were reviewed, along with those proposed by Wang, Wu and Wang (2009) and Yang (2013). IL-HUMASS (Pinto, 2009) is a critical survey developed for a group of diverse degrees in Social Sciences and Humanities. It tackles four informational categories

(information search, assessment, processing and communication/dissemination) and three self-perceived dimensions (motivation, self-efficacy and preferred source of learning). EVAL-CI (Pinto and Fernández-Pascual, 2014) was developed to assess students' objective knowledge on information competencies. The work by Wang, Wu and Wang (2009) offers a scale that can be used to analyse the decisive aspects in the acceptance and use of mobile learning, and possible differential features, such as gender or age. The questionnaire provided by Yang (2013) deals with expectations on use and social influence of mobile teaching and its positive aftermath in the contexts of higher education.

2.   A way was found to create an original and valid questionnaire that addressed the current needs of students as well as the aspects they identify with the most.

3.   To validate the questionnaire, a rubric (Annex I) was created that considered four key areas (level of quality, clarity of items, usefulness and perceptions or opinions). It was shared with the volunteer students who had been chosen for this first phase of the test. The volunteers selected were fourth-year undergraduates majoring in Education at the University of Granada, the headquarters of the research project this study forms part. These students were chosen because they were nearing the end of their university education and, in light of the degree to which the required competencies had been acquired, they had a more critical attitude, were more mature and therefore had a greater ability to contemplate their teaching-learning process in higher education.

4.   To validate the coherence of the questionnaire and its level of efficacy and clarity, it was piloted with a representative sample of Education undergraduates whose involvement has enabled us to quantitatively validate the tool and provide its final version. Second-, third- and fourth-year students were selected for the pilot to ascertain whether there were any differences between their perceptions.

5.   Two focus groups were then created with volunteer students who were fourth-year undergraduates in Primary Education (n=30), belonging to two different academic specialties. During a two-hour period, certain conclusions were reached about the tool's quality, clarity and usefulness, as well as other aspects

regarding student availability, the time needed to complete the questionnaire and opinions about the methodologies used in classrooms (Pinto, Caballero-Mariscal, Fernández-Pascual, Sales and Guerrero-Quesada, 2019).

3.2. Questionnaire structure

The first version of the scale consisted of 22 items clustered in four dimensions using a five-point Likert scale: from "Totally disagree = 1" to "Totally agree = 5".

1) *The informationally literate university…*

The first dimension focuses on information competencies. Since this basic skill for university students is being compromised by certain endogenous and exogenous factors, it is an increasingly necessary competency that requires greater instructional effort, so the first section asks students about their perception of IL on a personal level as well as in the university setting they form part of. Therefore, the aim is to perform a descriptive analysis of students' thoughts on critical attitudes, accessibility and the degree to which new methods and mediums have provided access to information, as well as the increase in teaching-learning processes and their challenges, and the university's role in this area.

2) *An informationally literate person is one who…*

The tool's second dimension is based on the information competencies that someone classified as informationally literate should learn. It is believed that students should develop these skills during their undergraduate studies, so during this educational stage, it is important to analyse the perceptions of information literacy skills, which refer to the needs, analytical and critical skills, use and distribution of information.

3) *Rate the following statements*

The third dimension of the questionnaire is based on the Framework for Information Literacy for Higher Education (ACRL, 2015) and focuses on the key interconnected concepts regarding information and

its use, as opposed to standards or a prescriptive list of skills. As a result, it covers aspects linked to the authority and credibility of information, the value of information, research as questioning, knowledge creation as a form of dialog, and the strategies needed to search for and select information.

4)   ICT and students

The tool's last section refers specifically to the use of mobile technologies by students within the learning process. In addition to covering how devices are used in the classroom for everyday tasks (such as finding information), it analyses a key question that arises with the inevitable emergence of technology: how has technology influenced analytical-critical skills, and therefore its potential for creating distractions in the classroom.

4. Methodology

The questionnaire was validated in two stages. First, an evaluation rubric was designed and applied to a sample of 44 Education undergraduate students at the University of Granada. The rubric's qualitative and quantitative analysis provided useful information about the strengths and weaknesses of the questionnaire. A number of suggested improvements were proposed and the work team, upon reaching consensus, designed a second version of the tool that was applied to another sample of 105 Education undergraduate students. Throughout their university studies, the sample must complete two courses about technological resources applied to education. It should be noted that most of the materials covered regularly use group presentations in various formats as part of the methodology, so students are accustomed to using a number of apps and computer programs. To analyse the tool's reliability and internal validity, scale validation techniques and exploratory factorial analysis were used.

5. Results

The results are offered in two main sections: Firstly, the study on the quality and the coherence of the questionnaire is carried out by analysing the data from the evaluation heading in the first sample. Secondly,

the answers collected through the second sample of students are analysed, evaluating the internal consistency, the main gender and course differences, and the latent structures in order to validate the multidimensionality of the proposed scale.

5.1. Rubric Evaluation

Sample

The sample is made up of 44 undergraduate (fourth year) Education students from the University of Granada, between the ages of 21 and 36 years (average age of 25 and median age of 23). 63.6% are women. The sample was collected during the second term of 2018 (May, academic year 2017-18).

Design

The evaluation rubric is suitable and useful in order to evaluate both the quality and the coherence of the questionnaire from the view of the experts-teachers and to rate the items individually regarding their clarity (easy to understand, with simple statements) and relevance (the items should be clearly related to the subject of study). It uses the same 1-5 Likert scale that is applied to the questionnaire itself. On the scale referring to the rubric, 1 means that there is no match between the item of the questionnaire and its subject, meanwhile 5 would indicate an excellent match between the two: 1. Very low, 2. Low, 3. Medium, 4. High, 5. Excellent.

Analysis

The overall results of the questionnaire are broken down into the three dimensions addressed by the rubric (quality/coherence, clarity and usefulness), as follows:

a)   Clarity/Quality/Coherence.

PERSONAL DETAILS	Mean	Mode	SD
They are clear	3.98	5	.97

They are in a coherent order	4.14	4	.76
They are sufficient	4.14	5	.84
They respect privacy/anonymity	4.09	5	1.11
Global	***4.09***		***0.93***
INFORMATION ABOUT THE QUESTIONNAIRE (Instructions)	**Mean**	**Mode**	**SD**
It is clear and direct	4.05	4	.78
It is easy to understand	3.86	4	.98
The information is complete	4.02	4	.79
Does not lead to confusion	3.77	5	1.09
Any undergraduate student could follow them	4.09	5	.86
Overall	***3.94***		***0.93***
GENERAL COHERENCE AND QUALITY OF THE QUESTIONNAIRE	**Mean**	**Mode**	**SD**
The items are coherent	4.00	4	.68
They are clear and easy to understand	3.83	4	.93
The items are well grouped	4.05	4	.78
The questionnaire is useful	3.95	4	.88
It is comprehensive	4.05	4	.81
It is not excessively long	4.14	4	.71
It is not burdensome to fill out because it is short and agile	4.25	4	.72
The items are not repetitive	4.07	4	.78
Overall quality of the questionnaire	***4.07***		***.74***

Table 1: Evaluation rubric from the questionnaire: Evaluation regarding the personal details, instructions and overall coherence and quality.

According to the results, students believe that the instructions are suitable (clear and legible), giving an overall score of 3.94 points. They also rate the tool's overall coherence and quality with a score of 4.07 (on a 1-5 Likert scale).

b)   Clarity and usefulness of the items. We provide a two-dimensional analysis of the clarity and usefulness of the 22 proposed items as follows. The descriptive results show which items offer the greatest clarity usefulness, according to the students' opinion and those that should be reexamined (see Table 2, for categories).

Category	Clarity		Usefulness	
	Mean	**SD**	**Mean**	**SD**
1. The informationally literate university…	4.13	.87	4.12	.76
2. An informationally literate person…	4.15	.82	4.10	.85
3. Rate the following statements	*4.06*	.96	*4.09*	.87
4. ICT and students	**4.21**	.87	**4.23**	.78

Table 2: Evaluation rubric from the questionnaire: Evaluation regarding the clarity and usefulness of the proposed categories. (Maximum in bold, minimum in italics).

It can be observed that items 5 (Assumes that teaching will be of an increasingly ubiquitous or blended nature) and 12 (Authority is constructed and contextual) did not reach the minimum clarity levels (mean-0.5std) required by the work team, they were reformulated for improved comprehension.

5.2. Validating the pilot questionnaire

The internal consistency and reliability of the MOBILE-APPS questionnaire is evaluated from the main descriptive measures of the responses, and Cronbach's alpha values are analysed. Finally, the proposed categories are validated by applying an exploratory factor analysis to identify the structure and layout of the latent categories.

Sample

The second sample, collected during the second term of the academic year 2018 (June, academic year 2017-18), is made up of 105 undergraduates from the University of Granada, second-year (22.9%), third-year (12.4%) and fourth-year (64.8%) students between the ages of 19 and 50 years (average age of 22.35 and median age of 21). On this occasion, 62.9% are women.

Consistency

To examine the reliability, we calculate the Cronbach's alpha for each category. Alfa values exceed the recommended minimum of 0.7 (Nunnally, 1978), so the scales show a good level of reliability, except for the category 4- ICT and students (Table 3). The overall Cronbach's alpha of the MOBILE-APPS questionnaire was 0.851, which indicates a high level of reliability and internal consistency (Novick and Lewis, 1967; Osburn, 2000; Gliem and Gliem, 2003).

Analysis

The descriptive analysis reveals that the central values of student perceptions are between 3.8 and 4.03, with homogeneous criteria due to the low dispersion.

Category	Items	Mean	Median	SD	Alpha coefficient
1. The informationally literate university…	5	3.88	3.80	.54	.785
2. An informationally literate person is one who…	6	3.95	4.0	.60	.851
3. Rate the following statements	6	4.03	4.0	.55	.735
4. ICT and students	5	3.88	4.0	.65	.521
Overall	**22**				**.851**

Table 3: Descriptive Statistics and Reliability Estimates for the Student's Perception Questionnaire.

There are no gender differences (U Mann-Whitney, p>0.05) in the mean scores for each category.

We found significant differences in the mean scores by year of study in category 4- ICT and students (Kruskal-Wallis, p<0.05). This was due to second-year students giving lower scores, which means that they use ICTs less than what third- and fourth-year students do, and they have a lower perception of their academic use.

The analysis by items reveals mean scores between 3.48 and 4.23. The most common score is 4, and only item 21- Immediate access to information diminishes students' capacity for critical thinking, shows a dispersion that is higher than one, followed by item 18- How often my students usually take notes or search for information using mobile devices (laptops, tablets or smartphones) (Table 4).

Category	Item	Mean	Mode	SD
The informationally literate university…	1. Is the future of higher education	4.00	4	.760
	2. Fosters the critical and reflective training of the educational community	3.90	4	.766
	3. Fosters lifelong learning	3.93	4	.847
	4. Facilitates the teaching-learning process	4.11	4	.738
	5. Assumes that teaching will be of an increasingly more ubiquitous or blended nature	*3.48*	3	.983
An informationally literate person is one who…	6. Knows how to identify his or her information needs	3.85	4	.769
	7. Is familiar with and uses relevant and high-quality sources of information	4.05	4	.752
	8. Uses a variety of information resources (websites, databases, e-books, books, academic papers, etc.) with efficacy	4.16	4	.786
	9. Analyses sources of information in a critical manner	3.93	4	.839
	10. Cites the sources of information used in an appropriate manner.	3.82	4	.841
	11. Knows how to disseminate information in a rigorous and relevant way	4.01	4	.814
Rate the following statements	12. Authority is constructed and contextual	3.74	3	.788
	13. The creation of information is a process	4.03	4	.794
	14. Information has value	<u>4.23</u>	5	.869
	15. Research involves questioning	3.95	4	.903
	16. Learning is a dialogue	4.16	5	.810
	17. The search for information requires a strategy	4.04	4	.885
ICT and students	18. How often my students usually take notes or search for information using mobile devices (laptops, tablets or smartphones) (scale from 1 to 5: never, frequently, often… always)	4.14	5	1.051
	19. Mobile devices have led to students' being more distracted in class	4.16	5	.867
	20. Digital natives think that mobile technology affords them access to all the information they need	3.81	4	.936
	21. Immediate access to information diminishes students' capacity for critical thinking	3.49	4	1.170
	22. The use of ICTs results in students' granting less importance to citing sources	3.84	4	.823

Table 4: Descriptive Statistics of the Student's Perception Questionnaire by item.

Latent dimensions: Factorial analysis

With the aim to discover the interrelationships, the latent structures and to analyse the multidimensionality of the scale, an exploratory factor analysis is applied. The Kaiser-Meyer-Olkin (KMO) measure of adequacy reaches 0.774, indicating appropriateness of using factorial analysis (exceeds 0.5, the minimum value required, Kaiser, 1974; Tabachnick and Fedell, 2007).

Five factors were found (Preacher et al., 2013) explaining the 60.08% of the variance (Table 5). Details regarding the loading factors are displayed in Table 1A-Annex II).

Name of the factor	Items it is made up of	% explained Variance
F1: Informationally literate person	6-7-8-9-10-11	28.96
F2: Informationally literate university	1-2-3-4	10.46
F3: ICT and students	19-20- 21-22	8.99
F4: Critical dimension on Information Literacy	15-16-17	6.02
F5: Contextual dimension on Information Literacy	12-13	5.65
Global	**19**	**60.08%**

Table 5: Factorial structure, composition and % of explained variance.

As a result, categories 1, 2 and 4 are consolidated (1. The informationally literate university…; 2. An informationally literate person is one who…; 4. ICT and students), which are shown in factors 1, 2 and 3. To strengthen the consistency of category 3, an explanation was added between brackets to item 12, in accordance with the philosophy of the ACRL Framework, and it was agreed to leave item 5 unchanged. Lastly, the research team took into consideration several suggested improvements to the text and, upon reaching a consensus, the final version of the MOBILE-APPS questionnaire was created (Annex III).

6. Discussion and conclusions

Firstly, it is worth noting that the MOBILE-APPS questionnaire was processed and created separately from the MOBILE-APP scale, which was designed for teachers (Pinto, Sales, Fernández-Pascual and Caballero-Mariscal, 2018). In other words, these are two independent questionnaires. However, they work together and have been designed to measure the perceptions of students (MOBILE-APPS questionnaire) and teachers (MOBILE-APP questionnaire) in the area of Social Sciences and with regard to the use of mobile technologies in the process of teaching-learning information competencies.

The MOBILE-APPS questionnaire was designed in collaboration with renowned experts in this field, and the *Framework for Information Literacy* (ACRL, 2015) was reviewed and taken into account. This framework stresses that information literacy is key in ensuring that students are informed and critical citizens—from a perspective of responsible lifelong learning—with a willingness to evolve in light of contextual changes and technological advances, always with a critical focus.

The results obtained from our two-stage sequential validation (rubric distributed among volunteer students followed by the pilot and focus groups) confirm the scale's reliability and consistency.

First, the content validity that refers to the comprehensiveness and representativeness of the items in the scale was verified. To do so, a distributed evaluation rubric was used on the initial sample of 44 students, confirming high clarity and relevance of the proposed items, with mean values above 4 points and a low dispersion of less than one on a 1-5 Likert scale.

The pilot questionnaire was then distributed to a second sample of 105 students. The results showed favourable psychometric properties in terms of high reliability and a factorial structure in which the five sections or factors found are in line with the tool's structure, providing validity evidence of the proposed categories (Gadermann et al., 2010). Additionally, there were two focus groups that helped define the qualitative validation of the questionnaire in terms of its quality/relevance, clarity and usefulness.

The scores given by students revealed interesting scenarios in the field of mobile information literacy. Specifically, as expected, students with higher levels of education, contact and experience are expected to have higher perceived self-efficacy and also include mobile technologies in their teaching-learning processes to a greater degree. In other words, the perceptions detected differ according to year of study, resulting in higher scores among those who are further along in their education.

On the other hand, perceptions among genders are similar to the importance of these information competencies and the use of mobile technologies in the learning process. Some studies have already revealed that the gender variable is insignificant; gender is not a pivotal factor that influences self-efficacy and attitudes toward m-learning or m-entertainment (Yang, 2012; Leong et al., 2013). This result suggests and welcomes a more in-depth analysis using a larger student sample. We leave this possibility open for a future study, already in progress, in which we distribute the MOBILE-APPS questionnaire to a representative

sample of Social Sciences students in Spain. This will provide a global picture of the attitudes and perceptions on the use of mobile technologies for teaching-learning information competencies.

If other tools used in similar studies are taken into consideration, the one by Hanbidge, Sanderson and Tin (2015) is worth noting. They used a longitudinal study to measure the information competencies of Social Sciences university students (Education, Social Work, Psychology, Social Education and Development studies). The results, which showed the importance of m-learning in acquiring information competencies, were obtained using a tool that combined qualitative and quantitative methods. However, it differs from this scale (MOBILE-APPS) because it is not a validated questionnaire and the pilot was used on a small group of students (fewer than 100). The tool we validated in this study has more potential in light of its agility and applicability for many students.

Other tools used in a number of studies, as in the case of Alhassan (2016) and Al-Emran, Elsherif and Shaalan (2016), took into account the use of mobile devices in higher education as well as the attitudes of students and teachers towards the general use of mobile technologies in the classroom. Both cases confirm the need to adapt to the new reality and the benefits of using mobile technologies based on how apps improve the teaching-learning processes.

On the other hand, the setting plays a major role in acquiring those competencies. In any case, MOBILE-APPS introduces the combination of mobile-information literacy as a strength and an innovative aspect, as opposed to these two tools, which focus on using mobile devices, without directly including the mobile information literacy aspect that we believe is at the core of this study.

Lastly, it is important to consider the tool created by Doyle, Foster and Yukhymenko (2018). PILS (Students Perception of Information Literacy Skills) is based on the six fundamental pillars of the *Framework for Information Literacy in Higher Education*. The authors use those pillars to establish a scale of descriptors that define the level of information competency in students for every section, with seven different levels ranging from beginner to expert. Along these lines, we find commonalities with MOBILE-APPS since this frame of reference is fundamental in both instances. However, unlike the tools mentioned earlier, PILS only takes into account IL, without considering the use of mobile devices in the classroom and everything resulting from digital literacy.

In summary, MOBILE-APPS is a tool that combines the two basic aspects in the area of higher education (information literacy and mobile technologies), it is easy to manage and, when combined with the MOBILE-APP questionnaire (for teachers), can offer a dual instructor-student perspective about the perceived self-efficacy regarding the importance of information competencies and attitudes towards m-learning. This integrated perspective makes MOBILE-APP an innovative tool with an intriguing potential for wide-range studies.

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ANNEXES

Annex I. Evaluation rubric: Evaluation of the Quality/Coherence, Clarity and Usefulness of the items

EVALUATING THE QUESTIONNAIRE

Student perceptions on the importance of using mobile technologies in the process of teaching-learning information competencies.

DESCRIPTORS	LEVEL OF QUALITY					
PERSONAL DATA	VERY LOW			HIGH	EXCELLENT	No answer
They are clear						
They have a coherent order						
They are sufficient						
They respect privacy/anonymity						
Suggestions						
ABOUT THE QUESTIONNAIRE (Instructions)	VERY LOW				EXCELLENT	No answer
It is clear and direct						
It is easy to understand						
The information is comprehensive						
It does not lead to confusion						
Any undergraduate student could follow them easily						
Suggestions						
OVERALL COHERENCE AND QUALITY OF THE QUESTIONNAIRE	VERY LOW				EXCELLENT	No answer
The items are coherent						
They are clear and easy to understand						
The items are well grouped						
The questionnaire is useful for obtaining this information						
It is comprehensive						
Overall quality of the questionnaire						
It is not excessively long						
It is not burdensome to fill out because it is short and agile						

Every item provides useful information (they are not repetitive)						
Suggestions						

Below are a series of questions for which we ask you to rate your level of agreement with each of the statements using the response scale, with 1 = "I strongly disagree" and 5 = "I strongly agree".

INFORMATION ABOUT EACH ITEM THAT COMPRISES THE QUESTIONNAIRE	a) The item's clarity: easy to understand and interpret ←Strongly disagree — Strongly agree→					b) The item's usefulness: contribution of relevant information ←Strongly disagree — Strongly agree→				
The informationally literate university...										
1. Is the future of higher education										
2. Promotes critical and reflective thinking in the education community										
3. Fosters lifelong learning										
4. Makes the teaching-learning process easier										
5. Assumes that teaching will be of an increasingly ubiquitous nature (online education and blended learning)										
An informationally literate person is one who...										
6. Knows how to identify their information needs										
7. Understands and uses relevant and quality information sources										
8. Uses varied information resources (websites, databases, eBooks, books, academic articles, etc.) efficiently and effectively										
9. Evaluates information sources in an analytical and critical manner										
10. Properly cites the information sources used										
11. Knows how to disseminate information in a rigorous and appropriate manner										
Rate the following statements										
12. Authority is constructed and contextual										
13. Creating information is a process										
14. Information has value										
15. Research is a process of questioning										
16. Learning is a dialog										

17. The search for information is a strategic exploration										
The use of ICTs and mobile settings in the learning process										
18. I usually take notes or search for information on mobile devices (laptops, tablets or smartphones)										
19. I believe that I am able to access all the information I need using ICTs and mobile devices										
20. I believe that instant access to information improves my critical thinking skills when selecting verified information and documents										
21. The use of ICTs lowers the importance I give to properly citing sources										
22. Mobile devices have contributed towards me being more distracted in class										
Suggest ions:										

Annex II - Numerical results

Category	Item	Latent factor				
		Loading factors				
		F1	**F2**	**F3**	**F4**	**F5**
1.The informationally literate university…	1. Is the future of higher education		.533			
	2. Promotes critical and reflective thinking in the education community		.690			
	3. Fosters lifelong learning		.808			
	4. Makes the teaching-learning process easier		.603			
2. An informationally literate person is one who…	6. Knows how to identify their information needs	.572				
	7. Understands and uses relevant and quality information sources	.725				
	8. Uses varied information resources (websites, databases, eBooks, books…) efficiently and effectively	.660				
	9. Evaluates information sources in an analytical and critical manner	.765				
	10. Properly cites the information sources used	.759				
	11. Knows how to disseminate information in a rigorous and appropriate manner	.749				
3. Rate the following statements	12. Authority is constructed and contextual					.606
	13. Creating information is a process					.644
	15. Research is a process of questioning				.694	
	16. Learning is a dialog				.595	
	17. The search for information is a strategic exploration				.811	
4. ICT and students	19. I believe that I am able to access all the information I need using ICTs and mobile devices			.638		
	20. I believe that instant access to information improves my critical thinking skills when selecting verified information and documents			.667		
	21.The use of ICTs lowers the importance I give to properly citing sources			.552		
	22. Mobile devices have contributed towards me being more distracted in class			.660		
	% cumulative	**28.96**	**39.42**	**48.41**	**54.43**	**60.08**

Table 1A: Factor model for Student's Perception Questionnaire. Note: Factors are sequenced by order of importance.

Annex III. MOBILE-APPS questionnaire. Final version

STUDENT PERCEPTIONS ON THE IMPORTANCE OF USING MOBILE TECHNOLOGIES IN THE PROCESS OF TEACHING-LEARNING INFORMATION COMPETENCIES

Dear student,

The following questionnaire forms part of a research project on **Information literacy and the inclusion of mobile technologies in the process of teaching-learning information competencies (I+D CSO 80147-R)**. It is completely anonymous and the information will be handled with the corresponding confidentiality.

THANK YOU FOR PARTICIPATING

PERSONAL AND ACADEMIC DATA

Gender: Male   Female

Age: _____   **Nationality:** _____

Major:

Business and Management   Audiovisual Communication

Documentation   Economics Primary Ed. Journalism Pedagogy   Tourism

Year of study: 1st   2nd   3rd   4th   5th   6th

Teaching method: In-person   Blended   Online

University where you are enrolled:

Complutense   Granada   Jaume I   Murcia

Email: _____ (To participate in the gift card giveaway)

Below are a series of questions for which we ask you to rate your level of agreement with each of the statements using the response scale, in which 1 = "I strongly disagree" and 5 = "I strongly agree". If you do not have an opinion on the matter or would prefer not to answer, please select "DK/NO" (Don't know / No opinion).

	←Strongly disagree				Strongly agree→	
The informationally literate university......						
1. Is the future of higher education						
2. Promotes critical and reflective thinking in the education community						
3. Fosters lifelong learning						
4. Makes the teaching-learning process easier						
5. Assumes that teaching will be of an increasingly ubiquitous or blended nature						
An informationally literate person is one who...						
6. Knows how to identify their information needs						
7. Understands and uses relevant and quality information sources						
8. Uses varied information resources (websites, databases, eBooks, books, academic articles, etc.) efficiently and effectively						
9. Evaluates information sources in a critical manner						
10. Properly cites the information sources used						
11. Knows how to disseminate information in a rigorous and appropriate manner						
Rate the following statements						
12. Authority is constructed and contextual (i.e., The authority of information depends on the recipients' perception of the authority concept itself and the setting in question).						
13. Creating information is a process						
14. Information has value						
15. Research is a process of questioning						

16. Learning is a dialogue						
17. The search for information requires a strategy						
ICT and students						
18. I usually take notes or search for information on mobile devices (laptops, tablets or smartphones)						
19. I believe that I am able to access all the information I need using ICTs and mobile devices						
20. Instant access to information improves my critical thinking skills when selecting verified information and documents						
21. The use of ICTs helps lower the importance I give to citing sources						
22. Mobile devices have contributed towards me being more distracted in class						