# The Smartphone in the teaching-learning assessment process in Higher Education. Perceptions of teachers and students

## El Smartphone en los procesos de enseñanza-aprendizaje-evaluación en Educación Superior. Percepciones de docentes y estudiantes

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### Resumen

El dispositivo móvil que mayor acogida está teniendo en la actualidad es el Smartphone, simbolizando la revolución del Internet móvil. Aunque la incidencia de las tecnologías y formas de comunicación emergentes en la sociedad es innegable, en el ámbito educativo, supone un reto. Por ello, los objetivos de este trabajo se centran en detectar la importancia otorgada al Smartphone como herramienta al servicio de los procesos de enseñanza, aprendizaje y evaluación, por docentes y discentes de Educación Superior y, conocer los beneficios y dificultades apreciadas por el profesorado y alumnado universitario, sobre la introducción del Smartphone en los procesos de enseñanza, aprendizaje y evaluación. Para ello se ha diseñado, validado e implementado herramientas de recogida de información cuantitativas y cualitativas, aplicando dos cuestionarios, uno destinado a docentes (n=311) y otro a estudiantes (n=483) y, dos Focus Group con estudiantes (n=6) y profesores (n=6). Los resultados muestran que, a pesar de la baja implementación pedagógica del Smartphone, docentes y estudiantes perciben más ventajas que dificultades respecto a su introducción en las aulas universitarias.

### Palabras clave:

Evaluación formativa, Educación Superior, Smartphone, Percepción del estudiante, Percepción del docente

### Abstract

Smartphone is the mobile device which at present is having the best acceptance among the public worldwide, symbolizing an Internet mobile revolution. Although the impact of emerging technologies and forms of communication in society is undeniable, in education, it is still a challenge. Therefore, the objectives of this work are focused on detecting the implementation of Smartphone as a tool to the service of the teaching, learning and assessment for teachers and students of higher education, and know the benefits and difficulties appreciated by teachers and university students, related with the introduction of Smartphone in the teaching, learning and assessment processes. For this they have been designed, validated and implemented tools for collecting quantitative and qualitative information, using two questionnaires, one for teachers (n = 311) and other for students (n = 483) and two focus groups with students (n = 6) and teachers (n = 6). The results show that, despite the low implementation Smartphone teaching, teachers and students perceive more benefits than difficulties with its introduction in university classrooms.

### Keywords:

Formative Assessment, Higher Education, Smartphone, Student´s perceptions, Teacher's perceptions

The almost unlimited conditions of access to all sort of information through the use of emerging technologies, as indicated by Brazuelo and Gallego (2011), Puigvert (2006),

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Sevillano and Vázquez-Cano (2015) and UNESCO (2013), should be accompanied by training systems for its selection, contrast and assessment; that is to say, a parallel education which works towards perception, reception, comprehension, analysis and observation on information of every nature. Equally, a transversal education which can strengthen communication and teamwork through colloquia, debates, dialectical discussions, encouraging the output and re-elaboration of information as well as a reasoned, logical and coherent argumentation. This way we could generate generations of educated, critical and creative citizens adapted to the Knowledge Society.

In order to invigorate a new university dimension according to the current social and technological scenario, there is a need of reinforcing efforts in line with Sevillano and Vázquez-Cano (2015). They highlight the importance of a renovation, open attitude and an outgoing study from the professors as a cornerstone of the quality of the educational process in our society. Thus, it is necessary academics with a work methodology adapted to the requirements of the new access tools and information processing such as the mobile devices and its unlimited applications accessible anywhere and anytime (Vázquez-Cano, 2015).

Bearing in mind that the current generation of university students has higher education studies with skills and quite sophisticated technological attitudes (Godwin-Jones, 2009), the big challenge for the university is the hybridization of its organization and methodologies of the teaching-learning-assessment based on the emerging technology. As it has been pointed by the Horizon Report (2012, 2013, 2014, 2015), the main technological approaches for the next year in education could be summarized in: Mobile Learning, Social Network; On-lien Learning, Hybrid and Collaborative; Big Data; Flipped Classroom, BYOD, Cloud Computing, PLE, Gamification.

Among all the approaches mentioned before, this paper will be focusing on the Mobile Learning as the new challenge to tackle educational practice at university. The new university students are part of a generation who think and learn in an interactive way, they like exploring everything around them and they are in constant communication using mobile devices such as *Smartphones, PDAs* (personal digital assistants), portable videogames consoles and multimedia players to communicate among each other, share information, browse the Internet, listen to music, read books, play and take part of the virtual realities among other things (Ramos, Herrera & Ramírez, 2010). In this sense the mobile learning allows the learning conversation to be focused on the students thanks to the customized technologies, and all of this encourages a better communication among students and academics as well as a larger contextualization of the learning (Cochrane, 2010).

Likewise, as indicated by Sevillano and Vázquez-Cano (2015), the fact that these mobile devices such as the *Smartphone* belong to the users and are available twenty-four hours a day encourages the adaptation and accessibility to the contents according to the users' needs and individual abilities. Therefore, the introduction of the mobile devices such as the *Smartphone* in the learning-teaching process opens a wide range of multiple educational potentialities to be considered (Brazuelo & Cacheiro, 2010; Navaridas, Santiago & Tourón, 2013; Sandoval, García & Ramírez, 2012; Trinder, 2005). Various academics and institutions (Brazuelo & Gallego, 2011; González, 2014; Hernández, 2009; Kukulska-Hulme & Traxler, 2005; Luengo, 2012; Ramos, Herrera & Ramírez, 2010; UNESCO, 2013; Villalonga & Marta-Lozano, 2015) focus on the numerous advantages of the introduction of these devices as part of the educational process, pointing out the possibilities of communication, the ease of use, the opportunities they offer towards the customization and flexibility of the contents,

the increase of motivation and the encouragement of creativity.

However, despite the multiple advantages and possibilities of the use of the *Smartphone* in Higher Education, we cannot leave aside certain limitations (González, 2014; Luengo, 2012) such as the reduced size of the screen, the risk of addiction and dependence, and the need of a good Wi-Fi connection or distractions, among others.

In spite of the fact of the multiple possibilities of the introduction of the *Smartphone* in the Higher Education context, it is necessary to bear in mind that any technological device is just a tool at the service of tutoring goals and educational aims set beforehand by the professors, that is to say, none of these tools should become the core point of the educational practice. The ideal scenario is that the educators facilitate the learning process and promote new ways of teaching that can be more customized, located and collaborative, applying an active, thoughtful and participatory methodology, as well as accessible tools to encourage a formative and shared assessment of the learning process and its products.

Various projects have shown that the mobile technologies can simplify the assessments providing professors and students with more immediate indicators of the progress (Sevillano & Vázquez-Cano, 2015). In the face of the current stage of the Higher Education, students are the main protagonists, who play an active and participatory role as part of the formative process (Espinosa, Jiménez, Olabe & Basogain, 2006). Therefore, formative assessment appears to be a suitable system which encourages the improvement of the teaching-learning-assessment process, assessing and providing feedback to students who can think by themselves and undertake individual actions in order to optimize their own learning process (Romero-Martín, Castejón-Oliva & López-Pastor, 2015). In this sense, the mobile technologies, thanks to their interactive nature, feed students with immediate answers on their limitations and

potentialities, increasing at the same time professors' efficiency since they help automate the assignment and gathering of the assessments (Sevillano & Vázquez-Cano, 2015).

Along these lines, the market of the educational applications for *Smartphones* and other mobile devices is constantly growing due to the current demand brought from the users (Mora, 2013); it is possible to find mobile applications to encourage flexibility, communication, access to the information and ability to bring and assess contents on behalf of students and professors such as Socrative, Flashcards, Kahoot, Blackboard, Moodle, Busuu, among others.

## Objectives

In short, through this research, we seek to answer the following objectives:

– To figure out the weight of years of teaching experience, gender, academic rank and the branch of knowledge in the importance given to the *Smartphone* as a tool at the service of the teaching, learning and assessing process by Higher Education teachers.

– To look into the impact of age, gender, academic year, and branch of knowledge in the importance given to the *Smartphone* as a tool at the service of the teaching, learning and assessing process by Higher Education students.

– To know the benefits and difficulties assessed by professors, about the introduction of the *Smartphone* as part of the process of teaching, learning and assessment, according to the years of teaching experience, gender, academic rank and branch of knowledge.

– To analyse the benefits and difficulties appreciated by the university learners on the introduction of the *Smartphone* as part of the teaching, learning and assessment process depending on their age, gender, course and branch of knowledge.

## Method

### Participants

The specific context where this research has taken place is the University of Cantabria (UC). In this paper we have gathered data about professors and students of every bachelor's degree and university master over the academic year 2014-15.

In this research, a mixed methodology integrating quantitative and qualitative data has been used. For the quantitative study it has been selected a stochastic sample of n= 293 teachers and n=483 students, ensuring a confidence level of 95% and a margin of error of 5%. For the qualitative study, it has been selected 6 docents and 6 learners, ensuring heterogeneity. Tables 1 and 2 show the features of the participants' samples across the quantitative and qualitative study.

Table 1 - Features of quantitative sample of docents and students participating in the study

| ACADEMICS' SAMPLE | | STUDENTS' SAMPLE | |
|---|---|---|---|
| FEATURES | % | FEATURES | % |
| Gender: | | Gender: | |
| -     Male | 57,6 | -     Male | 30,2 |
| -     Female | 42,4 | -     Female | 69,8 |
| Years of teaching experience: | | Age: | |
| -     From 0 to 10 years | 50,5 | -     Less than 20 years | 18,0 |
| -     From 11 to 20 years | 23,2 | -     From 20 to 25 years | 61,1 |
| -     From 21 to 30 years | 15,4 | -     Over 25 years | 20,9 |
| -     From 31 to 40 years | 8,0 | | |
| -     Over 40 years | 2,9 | | |
| Area of knowledge: | | Highest course enrolled: | |
| -     Art and Humanities | 6,4 | -     1st Year | 21,1 |
| -     Science | 19,6 | -     2nd Year | 13,9 |
| -     Health Sciences | 13,2 | -     3rd Year | 21,3 |
| -     Social Sciences Law and | 32,8 | -     4th Year | 31,5 |
| -     Engineering and Architecture | 26,0 | -     Master | 12,2 |
| -     Other | 1,9 | | |
| Current academic rank: | | Area of knowledge: | |
| -     Professor | 9,6 | -     Art and Humanities | 3,7 |
| -     Teaching Fellow/ Professor (School) | 24,4 | -     Sciences | 3,3 |
| -     Teaching Fellow (School) | 4,2 | -     Health Sciences | 5,2 |
| -     Associate professor | 13,8 | -     Social Sciences Law and | 68,8 |
| -     Lecturer | 8,4 | -     Engineering and Architecture | 15,5 |
| -     Teaching Assistant | 6,8 | -     Others | 3,5 |
| -     Part-time Instructor | 14,1 | | |
| -     Research and Teaching Fellowship | 8,0 | | |
| -     Others | 10,6 | | |

Table 2 - Features of the qualitative sample of academics and students participating in the study

| ACADEMICS | | | | |
|-----------|--------|----------------------|------------------------------|----------------------|
| PARTICIPANTS | Gender | Years of Experience | Branch of knowledge | Academic Rank |
| P1 | Masculine | 12 | Engineering and Architecture | Teaching Fellow |
| P2 | Masculine | 25 | Art and Humanities | Teaching Fellow |
| P3 | Feminine | 7 | Social Sciences and Law | Lecturer |
| P4 | Feminine | 12 | Health Sciences | Teaching Assistant |
| P5 | Masculine | 7 | Law and Social Sciences | Part-time Instructor |
| P6 | Masculine | 14 | Sciences | Associate Professor |
| STUDENTS | | | | |
| PARTICIPANTS | Gender | Age | Area of knowledge | Course |
| S1 | Masculine | 28 | Art and Humanities | 1st |
| S2 | Masculine | 31 | Law and Social Sciences | 4th |
| S3 | Feminine | 21 | Health Sciences | 4th |
| S4 | Feminine | 19 | Law and Social Sciences | 2nd |
| S5 | Masculine | 23 | Engineering and Architecture | 1st |
| S6 | Masculine | 20 | Engineering and Architecture | 2nd |

### Data gathering tools

Four tools has been designed, validated and applied for the data gathering. Two questionnaires, one set aside for academics and the other for the student body as a quantitative technique for the data gathering and, two Focus Group, one aimed at the teaching staff and the other at the student body as a qualitative technique for the data gathering.

It has been ensured the reliability and validity measures of the two implemented quantitative tools, by using an analysis of the validity of the tools' content through the Delphi technique; a descriptive analysis of the items that defined the questionnaires, an analysis of construct validity, through confirmatory factor analysis and, internal consistency analysis (Cronbach' Alpha) for the study of reliability.

With regard to the validity of the content the expert judges assessed that the selection, organization and the writing of the item tools were excellent. Regarding the descriptive analysis, those items with anomalous behaviour were eliminated. In order to ensure the validity of the construct, analyses of the Principal Components were carried out with varimax rotation, eliminating from the components of the matrix those values that represent a level of saturation less than 0,5. Finally, and concerning reliability, the global score of Cronbach's Alpha's questionnaire set aside for the academics is of 0.980 and, in the case of the student body's questionnaire, the value obtained is of 0,975. This allows us to confirm that the tools have a very good internal consistency.

Finally, the questionnaires are made up of three big groups and nine dimensions. The scale of answers applied is called Likert type (1-4). In the table below we can see the dimensions that respond to the objectives of this paper.

Table 3 - Dimensions, items and conceptualization of the variables of the questionnaires which tackle the objectives of the study

| ACADEMICS' QUESTIONNAIRE | | | STUDENTS' QUESTIONNAIRE | | |
|---|---|---|---|---|---|
| **DIMENSIONS** | | **Nº OF ITEMS** | **CONCEPTUALIZATION** | **DIMENSIÓN** | **Nº OF ITEMS** | **CONCEPTUALIZATION** |
| General Importance of the*Smartphone* α= .885 | | 5 | Academics' perception on the importance and general relevance of the*Smartphones* | General importance of the*Smartphone* α= .831 | 4 | Students' perception on the importance and general relevance of the*Smartphones* |
| Guided introduction of the *Smartphone*as part of the process T/L/A | Benefits α= .843 | 6 | Academics' perception on the benefits of the guided introduction of the*Smartphone* as part of the process T/L/A | Guided introduction of the *Smartphone*as part of the process T/L/A | Benefits α= .935 | 6 | Students' perception on the benefits of the guided introduction of the*Smartphone* as part of the process T/L/A |
| | Difficulties α= .851 | 5 | Academics' perception on the difficulties of the guided introduction of the*Smartphone* as part of the process T/L/A | | Difficulties α= .832 | 5 | Students' perception on the difficulties of the guided introduction of the*Smartphone* as part of the process T/L/A |
| Introduction of the*Smartphone*at their discretion as part of the process T/L/A | Benefits α= .873 | 8 | Academics' perception on the benefits of the introduction of the*Smartphone* at their discretion as part of the process T/L/A | Introduction of the*Smartphone*at their discretion as part of the process T/L/A | Benefits α= .860 | 8 | Students' perception on the difficulties of the guided introduction of the*Smartphone* as part of the process T/L/A |
| | Difficulties α= .603 | 6 | Academics' perception on the difficulties of the introduction of the*Smartphone* at their discretion as part of the process T/L/A | | Difficulties α= .685 | 6 | Students' perception on the difficulties of the guided introduction of the*Smartphone* as part of the process T/L/A |

The different dimensions of the questionnaires have been selected as a result of the analysis of all the theoretical documentation and deep observation in this regard. In the case of the benefits and difficulties observed, due to the use of the *Smartphone*, it has been decided to classify them in two groups. First of all those coming from the fact that the academic has guided the introduction of the device as part of the process teaching-learning-assessment and, secondly, those generated when the academic

or the learner, at their own discretion, have decided to use the *Smartphone* as part of the learning tools.

On the other hand, the qualitative tools have been made up of seven big sets of semi-structured questions and, likewise, they were validated through the assessment of experts obtaining a very positive valuation. In this paper, the groups and questions to be considered, shared for both groups, are shown in the table below.

Table 4 - Groups and questions from the Focus Group which tackle the objectives of the study

| FOCUS GROUP ACADEMICS AND STUDENTS | |
|---|---|
| PARTS | QUESTIONS |
| IV. IMPORTANCE | · For which of the following activities do you consider the use of the *Smartphone* is important: teaching, management and organization, communication? Why?<br><br>· State why it is important for the university to provide the ways and resources to encourage the use of *Smartphone* in the classroom at university. In case of an affirmative answer  What actions could be undertaken?<br><br>· If one day you arrive at the University and you realise that you has left the *Smartphone* at home. What feeling do you have? How do you react? |
| V.   BENEFITS   AND DIFFICULTIES   OF   THE INTRODUCTION  OF  THE *SMARTPHONE*  AS  PART OF   THE   PROCESS TEACHING-LEARNING-ASSESSMENT | · What benefits and difficulties do you find in the introduction of the *Smartphone* as part of the process Teaching-Learning-Assessment for the university students? And for the professors?<br><br>· If you specifically have experienced the  introduction of the *Smartphone* in the classroom: What benefits and difficulties have you highlighted on behalf of the students? and as far as the academics are concerned? |

Due to the length of the two questionnaires used for the research, the links are shown below as follows:

- Students' questionnaires: https://encuestas.unican.es/encuestas/index.php/346939?lang=es
- Academics' questionnaires: https://encuestas.unican.es/encuestas/index.php/596187?lang=es

# Method

The supply of the quantitative tools to all the academics and students of the University of Cantabria was conducted online through LimeSurvey platform.

In the case of the qualitative tools, prior to the field work, the selected users were contacted, agreeing on a date and time to the development of each of the  Focus Group. Finally, both Focus Group were developed in September-October 2014 and had an average length of  80 minutes.

**Analysis of the data**

The analysis of the quantitative information has been undertaken through the statistical programme SPSS v.22. First of all a descriptive analyse is shown to know the behaviour of the different groups regarding the dependent variables that appear in the objectives and, afterwards, it is checked the

relationship of signification between the dependent variables (DV) and the values of the different independent variables (IV) of the study

With the intention of knowing the type of analysis to be done in every case, the assumptions of homoscedasticity and normality have been checked. Table 5 shows the values after Kolmogorov-Smirnov's test, regarding the normality of the sample for all the dependent variables (DV). In the cases when (p < .05), due to a breach on the normality criteria non-parametric analyses have been undertaken. In the cases when (p > .05) the assumption of homoscedasticity has been later checked.

Table 5 - Values of the K-S's test of the Dependant Variables (DV) based on the different groups

| VARIABLES | GROUPS | Test of KOLMOGOROV-SMIRNOV | |
| --- | --- | --- | --- |
| | | Value Z | Value p |
| General importance *Smartphone* | Academics | 1.725 | .005 |
| | Students | 1.725 | .000 |
| Guided-introduction *Smartphone's benefits* | Academics | 1.051 | .220 |
| | Students | 1.375 | .046 |
| Guided-introduction *Smartphone's difficulties* | Academics | 0.477 | .977 |
| | Students | 1.039 | .230 |
| *Smartphone's benefits* own initiative | Academics | 1.126 | .158 |
| | Students | 1.912 | .001 |
| *Smartphone's difficulties* own-initiative | Academics | 1.119 | .163 |
| | Students | 1.438 | .032 |

The analysis of the qualitative data has been undertaken through the programme Atlas.ti 6.0 that makes easier the sort, use and interpretation of the big amount of textual data. Following the hypothesis of the Grounded Theory (Glaser y& Strauss, 1967), we have developed an analytical study followed by a thought that has taken into account the information from the Focus Group, the researcher's knowledge and the interpretation of the data. Therefore, a set of codes have been established and deductive-inductive categories, with sub-categories, as it follows in the table below.

Table 6 - Codes, categories and subcategories established for the analysis if the qualitative data

| CATEGORY | CODE | SUBCATEGORY | CODE |
| --- | --- | --- | --- |
| *SMARTPHONE'S* INTRODUCTION EXPERIENCE *IN* PROCESS T/L/A | EX | PERSONAL EXPERIENCES | EX_PER (PER_EX) |
| | | ASSESSMENT ON EXPERIENCES | EX_VAL (ASS_EX) |
| *SMARTPHONE'S* INTRODUCTION BENEFITS AND DIFFICULTIES *IN* HIGHER EDUCATION | BYD | BENEFITS | BYD_B |
| | | DIFFICULTIES | BYD_D |

# Results

In this section it is shown the outcome as a result of the analysis of the quantitative and qualitative information gathered. For the explanation we have followed the order of the objectives originally suggested. We have established a relationship between the dimensions used in the analysis of the quantitative data and the qualitative categories.

Regarding the general importance given to the *Smartphone* as an educational tool on behalf of the academics, it has been stated that

the average score of the aforesaid variable (M = 2.434, s.d. =0.875) is slightly lower than the average value of the scale (2.5), therefore, we can confirm that the academics give an average importance to the *Smartphone* as a useful tool for teaching-learning-assessment process.

With the goal of confirming if there are significant differences regarding the general importance that the academics give to the *Smartphone,* depending on the values that the different independent variables can take and, due to the breach on the assumptions of normality (Table 7), non-parametric analyses have been undertaken accordingly. In order to analyse the differences regarding the

dichotomous variable 'Gender', the U test of Mann-Whitney has been undertaken. The Kruskal-Wallis test has allowed us to confirm the existence or lack of significant differences between those variables that show more than two values of answer. And, finally, the U test of Mann-Whitney has been used to know, in the case of those IV with more than two values of answer, among which those values appear to have the most significant differences.

In the table below, we can see in a summarized way, the relationship of relevance verified between the DV '*General Importance of the Smartphone*' and the different IV related to the first objective of the study.

Table 7 - Summary of the significant relationship between the variable "*General Importance of the Smartphone*" and the different IV

| IV | Value 1 | General Importance of the *Smartphone* | Value 2 | Value p |
|---|---|---|---|---|
| Branch of knowledge | Art and Humanities | < Significantly lower | Health Sciences | .005 |
| | Art and Humanities | < Significantly lower | Engineering and Architecture | .031 |
| | Sciences | < Significantly lower | Health Sciences | .001 |
| | Sciences | < Significantly lower | Engineering and Architecture | .002 |
| | Health Sciences | > Significantly greater | Social Sciences & Law | .004 |
| Academic rank | Professor | < Significantly lower | Associate Professor | .018 |
| | Professor | < Significantly lower | Teaching Assistant | .022 |
| | Professor | < Significantly lower | Part-time instructor | .000 |
| | Teaching Fellow/ Professor (school) | < Significantly lower | Part-time instructor | .001 |
| | Teaching Fellow (school) | < Significantly lower | Part-time instructor | .020 |
| | Associate Professor | < Significantly lower | Part-time instructor | .011 |
| | Lecturer | < Significantly lower | Part-time instructor | .015 |
| | Part-time instructor | < Significantly lower | Research and Teaching Fellowship | .003 |

As it can be observed there are no significant differences regarding the general importance that academics give to the Smartphone based on '*Gender'* and '*year of teaching experience*'. On the contrary, there seem to be differences based on the '*Branch of knowledge*', being the academics from the Health Science and Engineering and Architecture those that give more importance to the *Smartphone*. Likewise, regarding the

"*Academic rank*", it is highlighted how those lecturers either Teaching Assistants or Part-time instructors, are those to give the most importance to this tool, whereas Professors and Teaching Fellow are the least.

Having observed individually every single item that forms the variable, it is visible that the activity for which academics think the use of the *Smartphone* is more important is for the communication among their colleagues, being

the teaching practice the activity for which they give less importance to the *Smartphone*.

The qualitative information related to this first objective reveals that academics give an average importance to the use of the *Smartphone* in the formative process. Only half of the participants have used the tools in the class, and the valuation on the experience shows certain difficulties and limitations such as, the wrong use of the tool from the students, the lack of habit or demotivation in the use of the device, or the limitations based in the fact that not all the students own a mobile device. Likewise, those academics from the Health Sciences as the 'Branch of knowledge' are those more inclined to use the tool and, therefore, those that give the most importance to the device. Further below there are a few of the most representative comments included as an example:

P2: *"I've used the application to assess tasks and dissertations in the class"*

P4: *"At Nursery, we use the topic of the Smartphone quite a lot because there are applications for our work that allow us to diagnose".*

P5: *"It was interesting because it happened that some groups have forgotten the phone, what I didn't even believe for a while, it flashed 80 times per second, and others that they didn't even know how to snap a photo with the phone".*

Regarding the general importance given to the *Smartphone* as a tool at the service of the process of teaching-learning-assessment from the university students, the average score of the variable (M = 3.020, s.d. =0.651) was greater than the average value of the scale, thus, the students give great importance to the introduction of the *Smartphones* in Higher Education.

The same non-parametric tests have been undertaken in the case of academics to verify the significant relationships between the dependent variable and the different VI related to this second objective, due to the fact that there is a breach, again, on the assumption of normality (Table 5).

The relationships of signification verified are shown in the table that appears below.

Table 8 - Summary of the significant relationships between the variable '*General Importance of the Smartphone*' and the different IV (Students)

| IV | Value 1 | *Smartphone general importance* | Value 2 | Value p |
|---|---|---|---|---|
| Gender | Male | < Significantly lower | Female | .027 |
| Age | From 20 to 25 years | > Significantly greater | Over 25 years | .014 |

It should be pointed out the lack of significant differences regarding the variables "Course" and "Branch of knowledge". However, it has been verified that women give an importance to the *Smartphone* for educational tasks significantly greater than men and, students between 20 and 25 years, give more importance to the device than older students. Having analysed individually the behaviour of the different items that form the variable, it has been confirmed that they give to the *Smartphone* a high importance for

management, organization and communication tasks.

The analysis of the qualitative data ratify that students give a great importance to the use of the *Smartphone* in the formative assessments. It follows a few relevant comments in that regard:

S5: *"For instance, during the Master, we used it to seek things or, for instance, to download an application to design outlines for websites in order to project it in a faster*

*way…. It was something handy and that provided immediate results. I thought it was very interesting and novel"*

S2: *"I think it is something very useful to seek for concepts and look for information. Sometimes when the teacher is explaining something if it happens to come up a word or something you don't know, you can look it up. Or for something out of curiosity."*

In order to tackle the benefits and difficulties that the academics of Higher Education perceive regarding the introduction of the *Smartphone* in the formative assessments, four variable have been analysed: benefits coming from the fact that the teachers give the guidelines for the introduction of the *Smartphone,* benefits coming from the introduction of the *Smartphone* at their discretion, as part of the formative assessments and, finally, difficulties perceived when both academics and learners use the *Smartphone* with educational aims as a result of their personal initiative.

Regarding the benefits perceived about the guided introduction of the *Smartphone* in the classrooms at University, academics provide

with a score slightly higher than the average value of the scale (M = 2.520, s.d. =0.697).

With regard to the difficulties linked to the guided introduction, academics bring a score slightly lower than the average point of the scale (M = 2.296, s.d. =0.761), that is to say, they perceive more potentialities than disadvantages.

In order to verify the existence or the lack of significant differences regarding these two DV, linked to the IV set in the third objective of this research we have analysed the same non-parametric tests used in the two previous objectives since, despite the compliance of the assumption of normality and homoscedasticity, we have done no-parametric analyses, due to the breach on the premise referred by Rubio & Berlanga (2012) who indicate the need of "n" values to compare, being not lower than 30 to carry out parametric analyses.

The table below gathers the relations of relevance verified between the variable "*Benefits from the guided introduction of the Smartphone* and the different IV of the study.

Table 9 - Summary of the significant relations between the variable *Benefits from the guided introduction of the Smartphone* and the different IV (Academics)

| IV | Value 1 | Guided introduction of the *Smartphone*Benefits | Value 2 | Value p |
|---|---|---|---|---|
| Branch of knowledge | Art and Humanities | < Significantly lower | Social Sciences and Law | .024 |
| | Art and Humanities | < Significantly lower | Engineering and Architecture | .030 |
| | Sciences | < Significantly lower | Engineering and Architecture | .023 |

It is noticeable the lack of significant differences linked to the "*Branch of knowledge*", "*Gender*" and "*Years of teaching experience*", with regard to the benefits coming from the guided introduction of the *Smartphone*. There only appear differences linked to the "*Branch of knowledge*", being the academics from Engineering and Architecture and Social Sciences and Law those that bring scores significantly higher.

In the case of the variable that represents the difficulties coming from the guided

introduction of the Smartphone, there have not been significant differences in the values that the different independent variables can take.

Having analysed the items of the two variables separately, we can highlight that the academics weigh up the development of the data processing and the digital competency as the benefit that most encourages the guided introduction of the *Smartphone* in the class. And the possibility of bringing inequality, since not all the students own a *Smartphone*, appears as the greatest difficulty perceived.

Regarding the benefits perceived about the introduction of the *Smartphone* at their discretion as part of the formative assessments, academics give a high valuation on the benefits as a result of the introduction of the *Smartphone* (M = 2.924, s.d. =0.715).

With regard to the difficulties related to the introduction of this tool at their discretion, academics bring a low valuation on the existence of difficulties (M = 2.261, s.d. =0.627).

In order to verify the relationship of significance not only between the DV "*Benefits from the introduction of the Smartphone at their discretion*" but the DV "*Difficulties from the introduction of the*

*Smartphone at their discretion*" with regard to the different IV, we have undertaken parametric analyses only in the IV "Gender" through the t test for independent samples, since all the assumption are accomplished (homoscedasticity, normality, n greater than 30). On the contrary, the relations between the DV "*Benefits from the introduction of the Smartphone at their discretion*" and the rest of the VI have been analysed through non-parametric tests.

In the table below appear the relationships of relevance verified between the variable "*Benefits from the introduction of the Smartphone at their discretion*" and the different IV of the study.

Table 10 - Summary of the significant relations between the variable *"Benefits from the introduction of the Smartphone at their discretion and the different* IV (Academics)

| IV | Value 1 | Benefits from the introduction of the Smartphone at their discretion | Value 2 | Value p |
|---|---|---|---|---|
| Gender | Male | < Significantly lower | Female | .002 |
| Years of teaching experience | From to 10 years old | > Significantly greater | From 31 to 40 years old | .021 |
| | From 0 to 10 years old | > Significantly greater | Over 40 years old | .034 |
| | From 11 to 20 years old | > Significantly greater | Over 40 years old | .049 |
| | From 21 to 30 years old | > Significantly greater | From 31 to 40 years old | .018 |
| | From 21 to 30 years old | > Significantly greater | Over 40 years old | .025 |
| Academic rank | Professor | < Significantly lower | Teaching Fellow | .019 |
| | Professor | < Significantly lower | Teaching Fellow (School) | .014 |
| | Professor | < Significantly lower | Associate Professor | .006 |
| | Professor | < Significantly lower | Teaching Assistant | .001 |
| | Professor | < Significantly lower | Part-time instructor | .001 |
| | Professor | < Significantly lower | Research & Teaching Fellowship | .005 |

In this sense, we can verify that women perceive more benefits than men, regarding the introduction of the *Smartphone* at their discretion in the formative assessments. Those academics with a teaching experience greater than 40 years show a score significantly lower than those with less years of teaching experience. And, regarding the "*Academic rank*", professors are those to perceive less benefits.

Once again we cannot verify significant differences in the value that the different VI can take with regard to the difficulties coming

from the introduction of the Smartphone at their discretion as part of the educational activities.

Having observed separately every single item that forms the variables, we can appreciate that the benefits that are better assessed by the academics are the ease of use to contents anytime and anywhere and the convenience to handle the device. On the contrary the reduced size of the screen appears as the main difficulty.

It follows a network and two literal quotations extracted when analysing the

qualitative information with regard to this third objective that allow to dig even deeply into the outcome:

P6: *"Benefits, I would say, apart from the speed and agility, the variety of the applications, in other words, a lot of* possibilities, *I don't know which, but there do exist".*

P1: *Immediate information and that the world's greatest library is right here in front of you.*
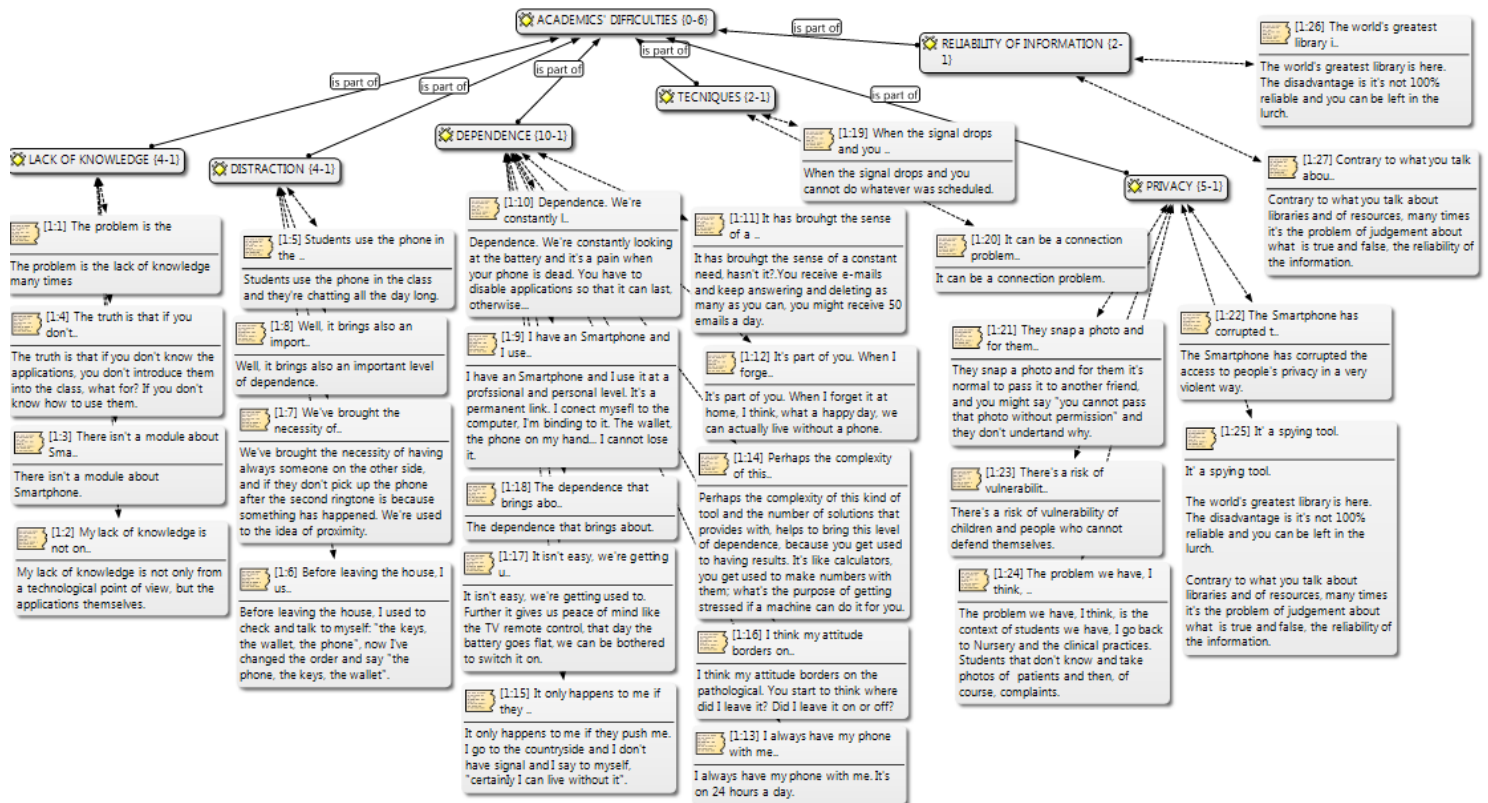


Figure 1 - Network difficulties Introduction of the *Smartphone* in teaching-learning-assessment process. Point of view of the academics.

The benefits perceived from the academics in the qualitative analyses refer to the speed, access to the information or communication. The most recurring limitation is the dependence followed by the problems caused by the vulnerability of the privacy.

Looking at the benefits and difficulties that university students show regarding the introduction of the *Smartphone* in the teaching-learning-assessment process, so do the academics' samples, it has been analysed four variables, two related to the benefits and difficulties that can appear when academics guide the introduction of the *Smartphone*, and two related with the benefits and difficulties caused due to the use of the *Smartphone* with

educational purposes at the discretion of academics and learners.

Regarding the benefits observed with the guided introduction of the Smartphone in the class at university, it can be confirmed that students give a high valuation (M = 2.808, s.d. =0.823). As far as the difficulties related to the aforesaid introduction are concerned, students show an average score (M = 2.579, s.d. =0.802). Therefore, student see more advantages than disadvantages in that regard.

With the intention to verify the existence or lack of significant differences related to these two DV, related to the values that can be given to the IV set in the fourth objective of this research, we have done the same parametric tests used in the three previous

objectives as, despite the compliance of the assumption of normality in the DV regarding difficulties (See Table 3), due to the breach on the assumption of homoscedasticity, analysed through Levene's test, non-parametric analyses have been carried out.

There is s no proof of significant relations with regard to the benefits caused when academies guided the introduction of the Smartphone in the class at university. Nevertheless, there appear differences in the difficulties as we can see in the table below.

Table 11 - Summary of the significant relations between the variable "Guided introduction of the Smartphone difficulties" and the different I V (Students)

| IV | Value 1 | Guided introduction of the *Smartphone* difficulties | Value 2 | Value p |
|---|---|---|---|---|
| Highest course enrolled | 1st year | < Significantly lower | 4th year | .003 |
| | 2nd year | < Significantly lower | 4th year | .000 |
| | 2nd year | < Significantly lower | Master | .024 |
| | 3rd year | < Significantly lower | 4th year | .004 |

We can observe the lack of significant differences related to the "*Branch of knowledge*", "*Gender*", "*Age*" with regard to the benefits coming from the guided introduction of the Smartphone. There are only differences related to the Academic course being the students from the 4th year and Master those that perceive the most difficulties regarding the guided introduction of the *Smartphone* in the classroom.

After having individually analysed the items of the two variables, we can highlight that students weight up the development of the information/digital competence and, the increase of motivation, as the main advantages coming from the guided introduction of the *Smartphone* in the classroom. So do the academics, they understand that the possibility of bringing inequalities among the learners is the greatest difficulty.

As far as the benefits perceived related to the introduction to the Smartphone at their discretion in the formative assessments, students show the highest valuation (M = 3.179, s.d. =0.608). On the contrary, they show a low valuation on the existence of difficulties regarding the introduction of the Smartphone at their discretion as part of the teaching-learning-assessment process.

Non-parametric analyses have been carried out, due to the breach on the assumption of normality (See table 5), to verify the relationships of signification between the DV "*Introduction of the Smartphone at their discretion benefits*" and the DV "*Introduction of the Smartphone at their discretion difficulties*" with regard to the IV evaluated.

In the table below, there appear relationships of relevance between the DV "*Introduction of the Smartphone for personal initiative benefits*" and the different IV.

Table 12 - Summary of the significant relationships between the variable "*Introduction of the initiative Smartphone Benefits*" and the different IV (Students)

| IV | Value 1 | Introduction of the initiative *Smartphone* | Value 2 | Value p |
|---|---|---|---|---|
| Gender | Male | < Significantly lower | Female | .006 |
| Age | Less than 20 years | < Significantly greater | Over 25 years | .002 |
| | From 20 to 25 years | > Significantly greater | Over 25 years | .000 |

It has been highlighted that women perceive more benefits than men, regarding the introduction to the *Smartphone* at their discretion in the formative assessments Likewise, student under 25 years old see greater advantages

Below there appear the existing relationships of relevance between the DV "*Introduction of the initiative Smartphone difficulties*" and the different IV.

Table 13 - Summary of the significant relationships between the variable "*Introduction of the initiative Smartphone difficulties*" and the different IV (Students)

| IV | Value 1 | Introduction of the initiative *Smartphone* difficulties | Value 2 | Value p |
|---|---|---|---|---|
| Gender | Male | < Significantly lower | Female | .019 |

The only variable in which we can observe significant differences related to the difficulties coming from the introduction of the Smartphone at their discretion as part of the formative assessments is "*Gender*", revealing one more time that women as those who perceive greater limitations.

After having analysed the behaviour of the items that take part of the two variables studied, we can observe that students agree with the academics on the easy access to contents anytime and anywhere and the peace of mind when carrying the device as the main benefits. On the contrary, the possibility of generating dependence appears as the main difficulty.

Below we indicate two literal quotations related to the benefits and a network regarding the difficulties that show the qualitative data of this fourth and last objective in order to deepen further in the outcome:

S1: "*What I value most is the possibilities of communication that it offers. It's very handy when you need help from your colleagues or for work team activities, doubts, exams' questions, and so on and I find it very interesting. Before it was much more complicated to communicate with your colleagues and now it's very easy, even with the professors*".

S2: "*One of the benefits is the quantity of information that you can get access to and the quick access to it anytime and anywhere*
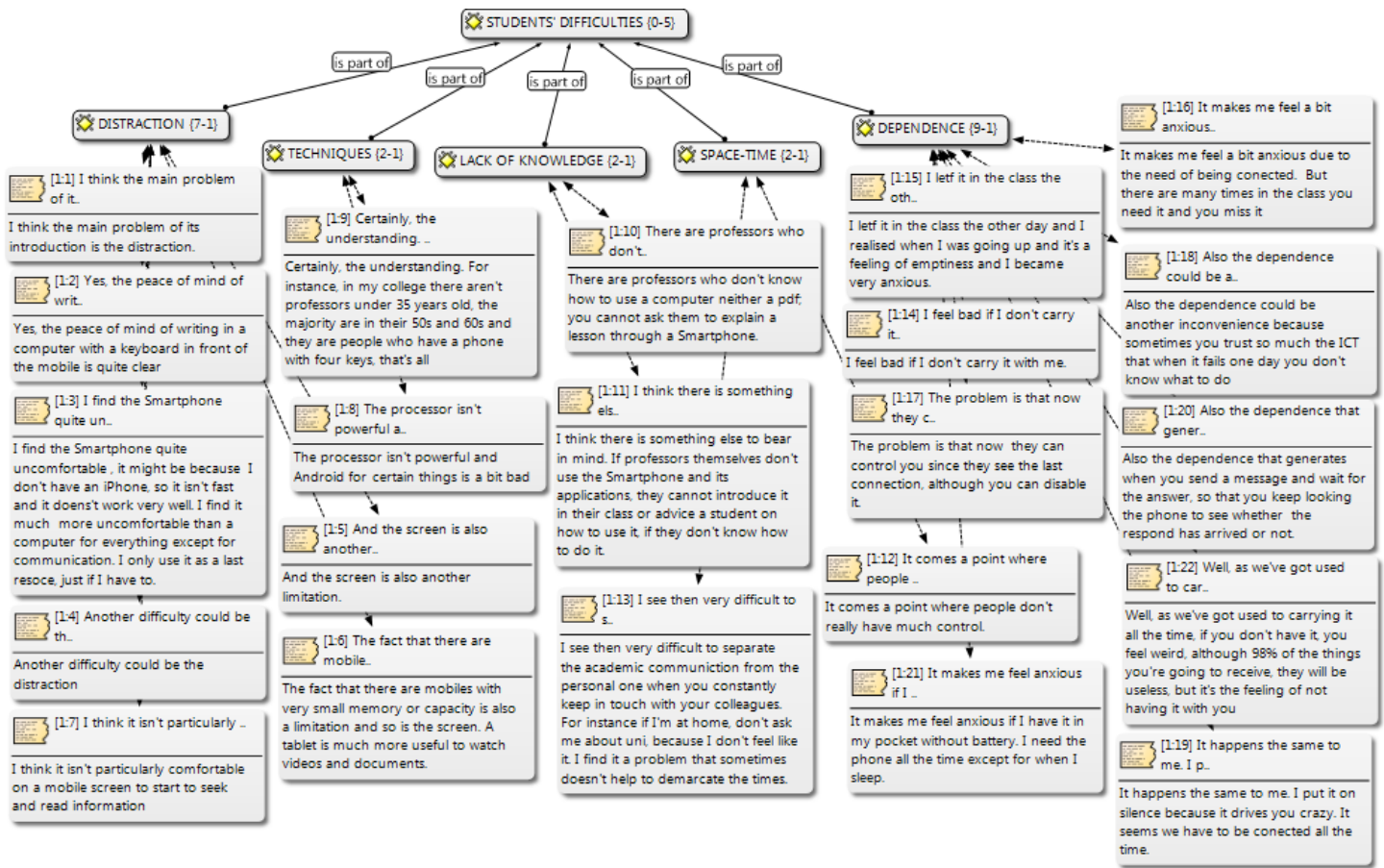
Figura 2 - Network difficulties Introduction of the *Smartphone* in teaching-learning-assessment process. Students' view.

The benefits perceived by students in the qualitative analyses, in the same way as the academics, reveal the speed, the access to the information and communication, The most recurring limitation is the dependence, followed by the risks originated by the access to the communication and information at all times and in all places.

## Discussions and conclusion

The general intention of this research was to analyse the view of both academics and students on the importance, benefit and difficulties regarding the introduction of the Smartphone in Higher Education.

As far as the two first objectives of the research are concerned regarding the importance given to the *Smartphone* as a tool at the service of the teaching-learning-assessment process by academics and learners, we highlight that students give an importance to the *Smartphone* greater than academics. The academics from the Health Science and Engineering and Architecture are those who give more importance to the device and, as far as the "Academic rank" is concerned, Professors, Teaching fellows and Teaching fellows (school) are those giving less, whereas Teaching Assistants, Part-time Instructors and Research and Teaching Fellowships the most.

In the case of the students, women and learners under 18 years old, are those who give the most importance to the *Smartphone*. Finally it is noticeable that both groups give a great importance to the Smartphone for communication tasks in line with the reserach of Brazuelo and Gallego (2011), Hernández (2009), Kukulska-Hulme and Traxler (2005), Luengo (2012), Ramos, Herrera and Ramírez (2010), UNESCO (2013) and Villalonga y Marta-Lozano (2015).

With regard to the last two objectives of the research, about academics' and students' perceptions regarding the benefits and difficulties of the introduction of the *Smartphone* in the teaching-learning-assessment process, it has been highlighted that, generally, students perceive greater benefits than academics. We should mention that the samples of professors and students who have developed guided experiences by academics in the educational use of the *Smartphone*, are lower than the sample of both groups who have used the device at their discretion with educational objectives.

Particularly, the benefits of the guided introduction of the *Smartphone* in the class are appreciated, to a large extent, by the academics of Social Sciences and Law and Engineering and Architecture with respect to the others "*Branches of knowledge*". Both students and academics state that the development of the digital competence is the greatest benefit of the guided introduction of the *Smartphone* in the classroom.

In relation to the difficulties that can appear when academies guide the use of the *Smartphone*, both groups show an average score, that is to say, they don't think that the introduction of the Smartphone at university has a negative impact in the adequate development of the educational processes. In both cases, the most outstanding difficulty is the possibility of bringing inequality between the students, since there might appear that not all the students own their own mobile device. As Brazuelo and Gallego (2011) indicate, we should bear in mind that these devices are relatively expensive and not accessible to all groups and educational institutions.

With regard to the benefits and difficulties of the introduction of the Smartphone at their discretion as part of the teaching-learning-assessment process, we can verify that both academics and students confirm that there are more benefits than difficulties.

Academics with experience superior to 40 years along with professors are those who give the least benefits to the introduction of the

Smartphone at their discretion. Regarding the variable "Gender", women are those who perceive the most benefits. The advantage particularly more valued by the academics and the learners is the possibility of access to the contents anytime and anywhere. A benefit that has been already endorsed by different researches (Brazuelo & Cacheiro, 2010; González, 2014; Navaridas, Santiago & Tourón, 2013; Ramos, Herrera & Ramírez, 2010; Sandoval, García & Ramírez, 2012).

On the other hand, the most outstanding limitation stated by academics is the reduced size of the screen, whereas students indicate the dependence as the most important difficulty. It is necessary to mention other difficulties included by academics due to the vulnerability of the privacy and reliability of the information; risks that don't appear in the limitations perceived by the students.

Finally we can see how the advantages (easy access to the information, accessibility, increase of the motivation, ease of communication) give priority to the difficulties of the introduction of the *Smartphone* in the educational contexts. Many of the limitations (decrease on students' attention, loss of control by academics, excess of accessible information, making the choice difficult, bring inequality as not all the students own a *Smartphone,* access to internet implies an additional cost) can be overtaken with an adequate continuous and supervised training by academies and university learners, as well as adequate technological resources by the institution. Thus, we should take the advantage of these devices to develop well-founded educational experiences that can make the most out of it.

In the light of these results, we can appreciate where the improvements should come from. The scientific research about the introduction of these mobile devices such as the *Smartphone* in the Higher Education is an emerging field with a great potential and appeal in education that has opened a wide range of educational practices which should be investigated. At the same time, it is necessary

to support with proofs, the benefits of the introduction of the *Smartphone* in the classroom, by setting a clear regulation about how and when the device should be used in Higher Education, avoiding people being banned, as this situation would turn a blind eye to reality. Equally, we should avoid adverse situations such as the loss of control in the classrooms, through practical assessments that help make the most out of this valuable educational tool.

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