FORMATIVE ASSESSMENT AT UNIVERSITY USING DIGITAL TECHNOLOGY TOOLS

Evaluación formativa en la universidad a través de herramientas tecnológicas digitales

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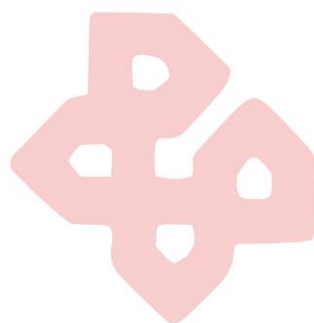*ORCID ID:* https://orcid.org/0000-0003-2426-0993
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Resumen:

La evaluación en sus diversas formas es un elemento clave en cualquier proceso de enseñanza. Esta investigación se centra en cómo se puede utilizar la evaluación formativa para mejorar el proceso de enseñanza-aprendizaje y proporcionar a los estudiantes comentarios sobre su progreso en lugar de solo calificaciones. El objetivo principal es analizar cómo los procesos de autoevaluación formativa individual, a través de la aplicación Socrative (SA) y los cuestionarios Moodle (MQ), afectan al proceso de enseñanza-aprendizaje y si mejoran el rendimiento y la satisfacción de los alumnos. Se ha utilizado una metodología cuantitativa mediante un estudio de caso. La muestra estudiada está formada por 374 estudiantes (315 mujeres) del segundo año del grado de educación. De estos, 245 formaron parte

de un grupo de control que no participó en ninguna autoevaluación y 129 formaron parte del grupo experimental. Los resultados muestran que el uso de herramientas de autoevaluación durante el proceso de enseñanza mejoró el rendimiento académico en aproximadamente un punto de cada diez y generó un buen nivel de satisfacción entre los estudiantes y los maestros. En general, no se encontraron diferencias significativas entre MQ y SA en relación al nivel de satisfacción y al rendimiento. Los resultados también indican que el uso de una herramienta de autoevaluación, por sí solo, no es suficiente para lograr un cambio en la forma en que los estudiantes aprenden. Por lo tanto, se deben investigar otros factores para conocer mejor las variables involucradas en el proceso de aprendizaje del estudiante.

Palabras clave: *autoevaluación; estrategia de aprendizaje; evaluación formativa; métodos de enseñanza; tecnología de la educación*

Abstract:

Assessment in its various forms is a key element in any teaching process. This research focuses on how formative assessment can be used to improve the teaching-learning process and provide students with feedback about their progress rather than just grades. The main aim is to analyze how individual formative self-assessment processes – via the Socrative application (SA) and Moodle questionnaires (MQ) – affect the teaching-learning process and whether they improve student performance and satisfaction. A quantitative methodology (a case study) was used.

The sample studied consisted of 374 students (315 women and 59 men) from the second year of the Teaching degree. Of these, 245 were part of a control group who did not participate in any self-assessment, and 129 were part of the experimental group (SA: 77 students and MQ: 52 students). Results show that the use of self-assessment tools during the teaching process improved the academic performance by around one point out of ten and generated a good level of satisfaction among students and teachers. Overall, no significant differences were found between MQ and SA in relation to satisfaction and performance. The results also indicate that the use of a self-assessment tool by itself is not enough to bring about a change in the way students learn. Thus, other factors should be investigated for greater insight into the variables involved in the student learning process.

Key Words: *educational technology; formative evaluation; learning strategy; self-evaluation; teaching methods*

1. Formative assessment as a key element in the teaching and learning process

Assessment is a fundamental component of every teaching-learning (T-L) process. Exactly how it is used will depend on its purpose or function, the moment, the agent, the referent, the methodology or the instruments. Traditionally, assessment has been used to obtain information about students' learning outcomes. In this regard, it has had a summative rather than a formative or diagnostic function (Gil-Flores, 2012). However, in the university context, the advent of the European Higher Education Area (EHEA) brought about a series of changes in the conception of assessment, including greater emphasis on its formative role, its involvement in improving T-L processes, its focus on different types of learning content and competences, and the continuous nature of the process (López-Pastor, 2012). In this regard, we focus on formative assessment because it is not just a qualification system

but gives universities the chance to modify and improve the T-L processes and guide students (Combrinck & Hatch, 2012). The assessment process involves focusing on the role of "the learner who learns", rather than the role of the "teacher who teaches" (Ibarra & Rodríguez, 2010). It entails giving greater importance to the active participation of students and their involvement in the process (Harris & Brown, 2018; Hortigüela-Alcalá, Pérez-Pueyo & López-Pastor, 2015).

Another challenge in terms of assessment in the university context is to reinforce students' ability to manage their own learning process and their autonomy to continue learning (Gargallo, Garfella, Sahuquillo, Verde & Jiménez, 2015). To this end, it is essential that students participate responsibly in their assessment so that they can gain greater insight into assessment and regulate their own learning process (Buscà, Pintor, Martínez & Peire, 2010; Nicol, 2010; Wanner & Palmer, 2018). The concept "learning-oriented assessment" (Carless, 2017; Carless, Joughin & Mok, 2006) involves mobilizing the capacities students need to carry out self-assessment processes: analyzing their own learning, making value judgments and taking decisions about their learning needs (Gil-Flores & Padilla, 2009). Recently, Panadero, Jonsson & Botella (2018) highlighted the importance of self-assessment in encouraging students to use learning strategies and motivation, specifically in terms of self-efficacy.

In consequence, formative assessments need to be designed to include the student's perspective through individual self-assessment (Poth, 2018). Therefore, teachers must include the feedback students will need to self-regulate their learning process in their teaching planning (Beaumont, O'Doherty & Shannon, 2011; Canabal & Margalef, 2017). In addition, three factors that influence the quality of the feedback received by students have been identified: the time elapsed before they receive it, the format used, and the amount of detail provided. These factors should be considered if feedback is to be effective and improve student performance (Ferguson, 2011).

2. Digital technology resources for student assessment

The technology used in classrooms has changed in recent decades from analogue to digital. This change has generated considerable debate between its proponents and its detractors (Awwad, Ayesh & Awwad, 2013; Luppicini, 2012; Parker, Bianchi & Cheah, 2008; Rashid & Asghar, 2016; Rivero, Chávez, Vásquez & Blumen, 2016). Today's reality is that digital technology, especially personal technology, is constantly present in university classrooms, although the level of digital competence among students varies considerably (Sevillano, Quicios & González, 2016). Students use information and communication technologies (ICT) for many reasons, ranging from basic notetaking to searching for information, presenting content, solving T-L activities or communicating. Although not all students have the same command of this personal and academic use of technology, these "new apprentices" all use technology naturally and in a way that is quite unlike how it has been used to date (Cheung & Hew, 2009; Díaz-García, Cebrián-Cifuentes & Fuster-Palacios, 2016; Henderson, Selwyn, Finger &

Aston, 2015). This natural use of technology by the new generations provides opportunities for learning that can be taken advantage of.

Of the devices found in university classrooms, laptops are the most common and fixed devices are being used less and less during teaching activities. This is made possible by the connectivity of universities and by the generalized use of laptops by students, which allow them to work in different places (López & Silva, 2016; Sevillano, Quicios & González, 2016). Mobile technological devices (including laptops) give access to information and communication anywhere, any time, and this means that they have great potential for learning in the classroom (Mills, 2015). Research suggests that the use of digital technologies can improve students' learning (Cheung & Hew, 2009; Lai, 2011). In this regard, there are several reasons why digital technologies can be used to improve the quality of feedback received by students during their formative assessment:

- The time factor: feedback using digital technology is immediate.

- The format: the feedback resulting from interactions is received on a personal device adapted to the user and it can be received in a variety of formats (text, audio, video, etc.), which makes the messages much richer.

- They facilitate access to a wide range of complementary resources available on the internet.

Suitable feedback using digital technologies should allow students to guide their learning, increase their motivation and make decisions during their learning process to improve their results while they actively participate in their own assessment process without necessarily having teachers present (Bloxham & Campbell, 2010, Ibarra & Rodríguez, 2010; Lafuente Martinez, Alvarez & Remesal Ortiz, 2015; Panadero et al., 2017).

This study will explore the potential benefits for university students of using two self-assessment digital instruments: Moodle Questionnaires (MQ) and the Socrative Application (SA).

3. Research questions, objectives and hypothesis

This study aims to respond to the following research questions:

- Does a process of continuous self-assessment improve students' academic outcomes?

- What differences, if any, are there between the academic results of students who use Moodle Questionnaires (MQ) and those who use the Socrative Application (SA) for continuous self-assessment?

- How do students and teachers value the use of the two self-assessment instruments (MQ and SA)?

- Is there a correlation between the students' overall academic performance in a subject and their self-assessment performance?

In terms of formative assessment, which improves T-L processes and requires students to manage their own learning and participate in their own assessment, and bearing in mind that digital technology is very present in the classroom, the study aims were:

1. To analyze the impact of a self-assessment component in one subject of the Teaching degree on student performance.

2. To use two digital resources – Moodle Questionnaires (MQ) and the Socrative Application (SA) – for student self-assessment and compare their impact on academic results and the satisfaction of the agents involved (students and faculty).

3. To assess the correlation between student academic performance in a subject and their self-assessment performance.

Based on these objectives, and taking into account previous evidence on student involvement in learning, student autonomy, and T-L processes being improved by formative assessment and digital technology, we formulated the following hypotheses:

- Incorporating the SA and MQ self-assessment tools into the T-L process will be well valued by both students and faculty.

- Students who use either of the two self-assessment tools will perform better academically than students in the control group (traditional teaching without self-assessment).

- Students who carry out the self-assessments on an ongoing basis (SA) – after each block of content – will perform better academically than students who do not necessarily assess themselves immediately after the contents are taught in the classroom (MQ) but freely decide when to do so.

4. Method

We decided to conduct an interpretive or explanatory case study with a quantitative methodology because it allowed us to go beyond conceptual or phenomenal description and get to the cause of the phenomena (Abero, Berardi, Capocasale, García & Rojas, 2015, p.70). According to Cohen, Manion & Morrison (2002, p.253), case studies reveal both cause and effect relationships in a specific context.

4.1. Participants

The sample consists of students and faculty from the Degree in Early Childhood Education, the Degree in Primary Education and the Dual Degree in Early Childhood and Primary Education of the Rovira i Virgili University in Tarragona (Spain). The students were in the second year studying the subject Learning Difficulties and Developmental Disorders in the academic years 2014–15 and 2015–16, and the faculty members were the teachers of this subject (N = 6, 83.4% women), who had been teaching for an average of 10.20 years (SD = 3.63). The sample of students included 374 students aged between 18 and 42 (M = 20.91, SD = 3.08) of whom 15.78% were men (315 women and 59 men). This ratio between men and women is quite usual for Teaching degrees (2:10).

The participants were divided into two groups: a control group of 245 students who were not involved in any teaching innovation (that is, they did not use a self-assessment method) and an experimental group of 129 students, who performed self-assessments through SA or MQ (see Table 1). The students in the experimental group were randomly assigned to one of the two conditions (self-assessment with MQ or SA), but care was taken to include in each condition students studying different degrees at different times (morning or afternoon).

In the experimental group, the number of self-assessment questionnaires filled in by students was recorded. This enabled us to eliminate those students who had completed fewer than 70% of the self-assessment questionnaires (i.e. four or fewer of the total of seven). Finally, 56 students were excluded for this reason, 45 of whom carried out the self-assessment questionnaires with SA and 11 with MQ.

The final sample of the experimental group, consisting of 129 participants who completed between five and seven self-assessment questionnaires, were divided into two groups: (a) the "SA self-assessment" group with 77 students and b) the "MQ self-assessment" group, with 52 students.

Table 1
Distribution of the sample per academic year, degree and group.

|	Year	Primary Ed.	Early Childhood Ed.	Dual Degree	All Degrees	
Control group	2014-15	90	96	38	224	
(without self-assessment)	2015-16	14	6	1	21	245
SA self-assessment group	2015-16	11	35	31	77	
MQ self-assessment group	2015-16	38	14	0	52	129
Total	2014-16	189	169	72	374	

Source: Own elaboration based on research data.
Note: (SA) Socrative Application, (MQ) Moodle Questionnaire, (Ed.) Education.

4.2.   Instruments

The instruments used to conduct the research were the following:

* Socrative Application by Mastery Connect (SA) is a free application for mobile devices that can also be used on the website (www.socrative.com). It is generally used to assess students' knowledge in real time. There are two versions: one for teachers and one for students. With the teacher's version, the teacher opens a questionnaire, which can include multiple choice questions, short answer questions, or true-false questions. In this study, only self-assessment multiple-choice questions were used. Students log onto the session with a code provided by the teacher and, as they respond to the questions, they receive feedback (correct/incorrect with the possibility of an additional explanation). The questionnaires can be created and answered quickly and nimbly by the users, and the teacher can see the results in real time. The application then uses the data collected to provide different types of report. Group reports include percentages of success per student and per question. These reports provide an instant view of the students' levels of understanding and learning.

Figure 1. SA example.
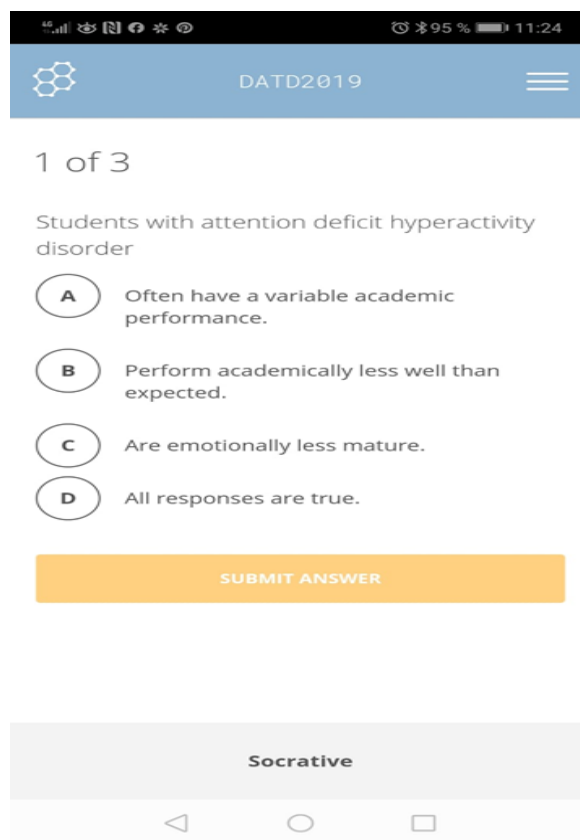
Source: Screenshot of a sample question using the Socrative Application.

- Moodle questionnaires (MQ) is a free application for mobile devices that can also be used on the web (www.moodle.org). It is a virtual educational environment that creates communities of learning online. It has considerable potential and its functionalities are numerous. One of the functions of Moodle is to create questionnaires so that students can answer questions of various kinds. These questionnaires can contain multiple-choice questions or short- or long-answer questions; the time of free access to the questionnaires can be limited and it can be graded. They are straightforward to set up, but various parameters need to be controlled and managed. This requires training or user guides.

- Application assessment survey (Quiroga Fernández-Sánchez, Escorial, Merino & Privado, 2015). At the end of the subject, a satisfaction survey was conducted with students and faculty to assess the experience of using SA and MQ and how they had affected performance. The survey items focused on students' attention and motivation, active learning and their relationship with the teacher. The response format for each of the items was 5 points (1 = very little, 2 = little, 3 = sometimes, 4 = quite a lot, 5 = a lot).

- Academic achievement in the subject Learning Difficulties and Developmental Disorders. In this study, we focused on the students' exam grades by: a) asking them a series of multiple-choice questions with four response options and b) making a case study in which students had to identify psychopathological difficulties and propose an educational intervention. We also focused on the students' final grades, which were calculated from several assessment activities (problem solving, oral presentations and the final exam) (see Table 2) that they had had to do during the course. All the grades were between 0 and 10. The purpose, time, kind of assessment and percentage of the final grade are detailed in table 2.

Table 2
Summary table of subject assessment.

Time and purpose of assessment	Assessment activities	Percentage of final grade
Initial: diagnostic assessment	- Oral test about previous knowledge	0 %
Continuous: formative assessment	- Problem solving	20 %
	- Oral presentation	20 %
	- Self-evaluation questionnaire	0%
Final: summative assessment	- Multiple-choice test	40 %
	- Case study analysis	20%

Source: Own elaboration based on research data.

4.3. Procedure

This study was carried out in accordance with the recommendations of Spanish organic law 15/1999 and the Spanish Agency for Data Protection, which regulate the fundamental right to the protection of data. This project and the protocol were approved by the ethical committee of our Faculty.

During the 2015-16 academic year, the teaching team incorporated a self-assessment method administered through SA or MQ into one of the second-year subjects on the Degree in Early Childhood Education, the Degree in Primary Education and the Dual Degree in Early Childhood and Primary Education. The self-assessment consisted of seven questionnaires of three multiple-choice questions (four response options) created by the teachers for each block of content in the subject (one questionnaire per block). The content and format of these questionnaires were similar to the multiple-choice part of the exam. The experimental group was divided into students who used SA and those who used MQ, and the same questionnaires were used for both self-assessment methods. The students who used SA completed the self-assessment in the classroom at the end of each block of content, while the MQ students were free to decide when to carry out the self-assessment, any time between the end of each topic and the date of the examination. The students' responses to the MQ and SA self-assessment questionnaires, and the date when they completed the MQ were recorded.

We measured performance on the self-assessment questionnaires with SA and MQ. That is, we calculated the average percentage of correct responses in the self-assessment questionnaires administered. At the end of the subject, students and teachers filled out the survey about their satisfaction with the teaching innovation implemented (MQ or SA self-assessment). The survey was administered using the same tool that had been used in the self-assessments: MQ or SA.

4.4. Data analysis

Firstly, descriptive statistics were calculated on the students' delay in responding to MQ, the satisfaction of students and teachers with both instruments, and students' academic performance with the self-assessment tool used. Secondly, in order to examine the associations between the agents' overall satisfaction and the self-assessment instrument used, t-test analyses were performed for students, also separately per gender, and paired t-tests for teachers. In both cases Cohen's d was used to obtain the effect size. ANOVA was used to compare the academic performance of the different experimental groups of students (self-assessment with SA or with MQ and control group). Additionally, we calculated separate t-test analyses for SA and MQ groups in order to examine gender differences in academic performance. Finally, the degree of association between the students' academic performance in the subject and their performance in the self-assessments was calculated using Pearson's correlation coefficient and Fisher's Z test to compare the magnitude of both correlations: MQ versus SA. All the analyses were performed using the statistical package SPSS 23.0 and assuming a level of statistical significance of $p < 0.05$.
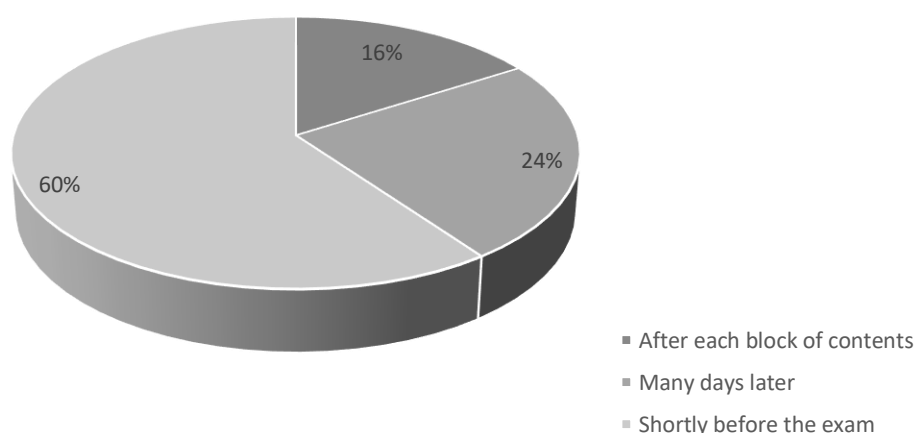
5. Results

5.1. Use of the self-assessment instruments

We analyzed how students used the two self-assessment methods and how these facilitated continuous assessment. To this end, in the application assessment survey, we asked them whether they "would like to be able to do the self-assessment when they saw fit". It should be remembered that the students who used SA answered the self-assessment questionnaire at the end of each block of content, so it was the teacher who decided when the evaluation took place, while the students who used the MQ chose for themselves when to answer the questionnaire. Both groups had only one attempt per block of content so that they would be on an equal footing. The response to this item was high in both groups, with a mean of 4.33 out of 5 (SD = 0.82) in the SA group and 4.5 (SD = 0.55) in the MQ group. There were no significant differences between the two groups (t (112) = -1,39, p = 0.167). These results indicate that both groups positively value their active participation in planning their own self-assessment process.

The students who conducted the self-assessment using the MQ were also asked in the survey about the delay in answering the questionnaires, which were available between the end of each block of content and the day of the exam. As can be seen in figure 1, most of the students (60%) answered the questionnaires shortly before the exam, since they used them as a measure to assess the knowledge that they had acquired and that was going to be evaluated in the exam (80% of the students). The other reasons they used to justify the delay were forgetfulness (6%) and their intention to study before responding (14%). On the other hand, only 16% of the students regularly answered after each block of content and 24% many days later. We also calculated the time that the students from the MQ group took to respond to the questionnaires. The average was over 1 month (M = 31.85 days, SD = 15.21).

Figure 2. Average delay (in days) in responding to the Moodle questionnaires.

- After each block of contents
- Many days later
- Shortly before the exam

Source: Own elaboration based on research data.

5.2. Satisfaction with the use of self-assessment tools

We compared the two tools, SA and MQ, from the perspective of the satisfaction of both students and faculty. The results (see Table 3) show that the degree of student satisfaction is similar with both instruments, since there are no significant differences between MQ (M = 3.51, SD = 0.47) and SA (M = 3.40, SD = 0.42). However, there are significant differences in teacher satisfaction. There is a large effect size (t (5) = 3.64, p <0.05, d = 2.90) between both instruments, and satisfaction with SA (M = 4.17, SD = 0.29) is higher than with MQ (M = 3.14, SD = 0.41).

In relation to gender differences in student satisfaction, neither men nor women show a particular preference for SA or MQ, but women score higher (M = 3.75, SD = 0.47) than men (M = 3.32, SD = 0.51) on satisfaction with MQ (t (41) = -2.07, p <0.05, d = 0.88).

Table 3
Descriptive and comparative statistics for student and teacher satisfaction with each tool.

	SA	MQ			
	Mean (SD)	Mean (SD)	*t*	*p*	*d*
Student satisfaction	3.40 (0.42)	3.51 (0.47)	$t_{(109)}$= -1.34	0.183	-0.22
Faculty satisfaction	4.17 (0.29)	3.14 (0.4)	$t_{(4)}$= 3.64	0.022	2.92

Source: Own elaboration based on research data.

Note: (SA) Socratic Application, (MQ) Moodle Questionnaires.

5.3. Achievement and learning

Figure 2 and table 4 show the data on the academic performance of the experimental groups and the control group in the subject analyzed. These data show that the students who conducted the self-assessments using the MQ and the SA performed better than the students in the control group, with the difference being around 1 point. That is, the students who completed some sort of self-assessment increased their final grade in the subject (F (3,373) = 18.01, p <0.001) by around 1 point, their grade in the exam (F (3,373) = 15.89, p <0.001) and their performance in the multiple-choice part (F (3,373) = 24.75, p <0.001). For the most applied part of the exam, the case study, there were no significant differences between the groups analyzed (F (3,373) = 0.71, p = 0.493). Thus, the groups that conducted self-assessments increased their academic performance in the subject by 10% independently of the self-assessment instrument used.

With regard to gender, we only found significant differences in the SA group: women showed better performance than men but only in the final grade [Women: M = 7.12, SD = 0.79; Men: M = 6.40, SD = 0.85; t (75) = -2.63, p <0.05, d = 0.88]. However,

this result is quite like the one found in the Control group [Women: M = 6.32, SD = 1.36; Men: M = 5.41, SD = 2.10; t (243) = -2.58, p <0.05, d = 0.51].

Table 4

*Descriptive statistics of the academic performance (0-10) of the students according to the self-assessment instrument used.*

	SA	MQ	None	F; p
	Mean (SD)	Mean (SD)	Mean (SD)	
Final grade	7.02 (0.83)	7.11 (0.96)	6.18 (1.53)	$F_{(3,373)}$= 18.01; *p*<0.001
Exam grade	6.34 (1.09)	6.46 (1.47)	5.40 (1.77)	$F_{(3,373)}$= 15.89; *p*<0.001
Exam grade (multiple-choice part)	6.02 (1.30)	6.17 (1.69)	4.69 (1.98)	$F_{(3,373)}$= 24.75; *p*<0.001
Exam grade (practical part)	7.08 (1.78)	6.85 (2.33)	6.70 (2.74)	$F_{(3,373)}$= 0.71; *p*=0.493

Source: Own elaboration based on research data.

Note: (SA) Socrative Application, (MQ) Moodle Questionnaires (*) p<0.05; (**) p<0.01; (***) p<0.001.

Figure 3. Average academic performance of the students according to the self-assessment instrument used.
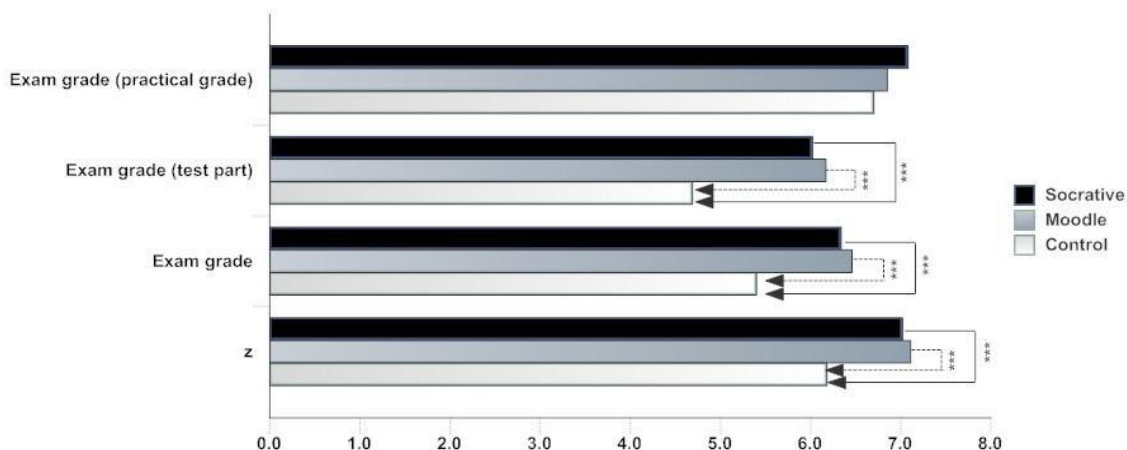
Source: Own elaboration based on research data.

Finally, table 5 shows that performance on MQ and SA presents moderate-to-low correlations with the various measures of academic performance in the subject. This relation is slightly greater with SA, although the difference between the two self-assessment instruments is not significant (z <1.96).

Table 5
Pearson's correlations between academic achievement in the subject and use of the self-assessment tools: Moodle and Socrative questionnaires.

	Performance SA/MQ	Performance SA	Performance MQ
Final grade	0.46***	0.44***	0.37**
Exam grade	0.42***	0.29**	0.33**
Exam grade (multiple-choice part)	0.45***	0.33***	0.30*
Exam grade (practical part)	0.23**	0.03	0.21

Source: Own elaboration based on research data.

Note : (SA) Socrative Application, (MQ) Moodle Questionnaires. (*) $p<0.05$; (**) $p<0.01$; (***) $p<0.001$

6. Discussion

This paper provides evidence on the impact that individual formative self-assessment using digital technology tools has on the academic performance of university students. The results indicate that using this type of self-assessment activity in the design of a subject improves students' academic performance and the satisfaction of both students and faculty. A comparison of two different questionnaires, MQ and SA, suggests that they both help to improve academic performance. Nevertheless, no significant differences were found between the use of MQ and the use of SA.

According to the assessment survey, students and faculty showed a medium and high level of satisfaction with MQ and SA, respectively. The students showed no differences in level of satisfaction with either method, whereas teachers showed greater satisfaction with SA. Teachers reported that SA allowed them to monitor student progress and encouraged active listening and daily teacher-student interaction, since the questions were solved face-to-face at the end of each session (Alexander, 2013; De Bruin, Thiede, Camp & Redford, 2011). On the other hand, from the gender perspective, our results did not show any statistically significant differences between women and men in in terms of their preference for one method or the other. However, women scored higher than men on their satisfaction with MQ. In this regard, a previous study has pointed out that women show more positive attitudes and higher levels of self-confidence than men when the experience in the use of the digital technology tools is significant, (Teo, 2008).

From a qualitative point of view, digital tools could a priori give students additional advantages, such as greater immediacy in the self-assessment of learning and continuous feedback on progress that helps them to plan their own learning (Wanner & Palmer, 2018). Therefore, as shown in previous studies, the use of SA for this purpose makes continuous assessment easier and facilitates greater engagement with the subject and better teacher-student communication (Awedh, Mueen, Zafar &

Manzoor, 2015; Dervan, 2014; Kaya & Balta, 2016). The students, however, did not seem to exploit these advantages because they valued other factors, such as being able to carry out the evaluation when and where they wanted. The results on the MQ group, who were free to decide when to carry out the self-assessment, indicated that only 16% of the sample engaged in continuous assessment, whereas 60% completed the assessment shortly before the exam. Thus, when students are free to plan their own learning process, they choose a summative assessment instead of a formative assessment. In this regard, a recent study shows that if summative assessments are to benefit learners, they should contain formative assessment (Broadbent Panadero & Boud, 2017). Despite this evidence, it should be noted that digital self-assessment tools helped the students to study for the final exam and obtain better results.

The exam and subject grades were used as a measure of student academic performance. The results showed that the use of either MQ or SA self-assessment increased the subject grade and the grade in the multiple-choice part of the exam by an average of one point. In this respect, other studies have also found that academic performance can be improved by self-assessment tools such as the ones used in our study (the Socrative and the Moodle platform) or other ICT-based educational programs and/or platforms (Dakka, 2015; Méndez-Coca, & Slisko, 2013; Moreno, Iglesias & Yáñez, 2013). This improvement in academic performance may be due to the more active role of the students during the subject and a decrease in anxiety levels associated with assessment (Hortigüela-Alcalá et al. 2015; Panadero & Romero, 2014). Previous contact with assessment activities, like those used later in the exam is a training opportunity that may reduce anxiety. Therefore, including digital self-assessment as part of an academic subject may help improve students' academic performance.

Overall, the results suggest that although no significant differences have been found, the multiple-choice part of the exam, and the exam and subject grades tended to be slightly higher in the group that used MQ. This suggests that university students benefit more from self-assessment tools if they can use them flexibly, if they can use them when and how they want rather than being told what they have to do. As mentioned above, some of the potentialities of the Socrative tool are lost, such as the possibility of continuous assessment, the control that the teacher can have, the immediacy of feedback for student and teacher, the greater interaction between them and also that it may be more portable and functional than MQ. This shows the importance of considering student preferences and needs when new methodologies are used in subjects.

7. Implications, limitations and future research

The present results add further insight to the study of formative assessment at university using digital technology tools. By giving students an opportunity to assume a much more active role in their learning process, these measures are intended to improve their academic outcomes and change current university T-L processes.

Moreover, Hamodi, López-Pastor & López-Pastor (2017) suggested that the formative assessment students of infant and primary education were personally involved in could be useful and applicable in their role as future teachers. This implies that the opportunity is much more important than it was first thought.

This study has some limitations. The first is that the sample consists only of students from one subject that is taught on three different Teaching degrees with a high percentage of women. The second is that the comparability of the groups was not measured before the intervention (in terms of ability, effort/hours of study, and motivation for learning). The third is that we cannot know the extent to which motivation to use new tools played a role. In this regard, future research should include a broader and more representative sample of university students and analyze whether self-assessment through ICT increases motivation and academic achievement. Future studies should also address examination age and gender differences in self-assessment.

8. Conclusion

In answer to our research questions, the results indicate that the use of self-assessment improved the academic outcomes of our students, and the correlations with academic performance were moderate-to-low. Likewise, no differences were observed between the administration of MQ and SA, and satisfaction with both instruments was expressed with appropriate student and teacher ratings. Finally, the present study suggests that the use of a self-assessment tool by itself is not enough to change how students learn. Teachers need to act as promoters of change in student learning behavior so that they take on a more active role in their learning process (Hortigüela et al.,2015). Moreover, teachers should provide students with the tools they need for efficient and meaningful learning. The advantages of formative self-assessment can be used to move from the "teacher who teaches" paradigm to the "learner who learns" (Carless et al., 2006; Ibarra & Rodríguez, 2010; Marcelo, et al., 2014). This is quite a challenge for teachers (Yot & Marcelo, 2017) since it will take them longer to plan and prepare their subjects because they must include self-assessment activities.

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