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ORIGINAL

How to Embed SRL in Online Learning Settings? Design Through Learning Analytics and Personalized Learning Design in Moodle

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ABSTRACT

One of the main generic competencies in Higher Education is "Learning to Learn". The key component of this competence is the capacity for self-regulated learning (SRL). For this competence to be developed, peer feedback seems useful because it fosters evaluative judgement. Following the principles of peer feedback processes, an online peer feedback proposal was created in the context of complex tasks in several degree courses (n = 448 students) at the University of Barcelona. A specific didactic sequence supported by digital technologies through Moodle was designed and validated after a deep analysis of the theoretical underpinnings of SRL models. A peer review proposal was ratified by the students, who pointed out the benefits of both receiving and, especially, giving feedback. The integration of Moodle tools with external tools such as Personalized Learning Design was highly valued by reviewers (n = 3 expert judges) and the possibilities for students to monitor their own progress through task completion was revealed as a positive aspect. Furthermore, the creation of personalized alerts to support learning processes also received a very high rating. The final model includes the changes derived from the validation process and suggests a reliable technology-supported intervention in an LMS, which is transferable to a larger scale.

Keywords LEARNING ANALYTICS, MOODLE, PEER FEEDBACK, PERSONALIZED LEARNING DESIGN, SELF-REGULATED LEARNING

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1 INTRODUCTION

The Lisbon European Council (23-24 March 2000) concluded that a European framework should define the new basic skills to be developed through lifelong learning. Since that moment, great efforts have been made to implement the Competence-Based Approach (CBA) in higher education institutions. Implementing the CBA and designing corresponding educational proposals have been a challenge (Struyven & De Meyst, 2010; Zlatkin-Troitschanskaia, Shavelson, & Kuhn, 2015).

All professional and generic competencies defined by employers, academics and stakeholders are important. However, the Personal, Social & Learning to Learn key competence (lifeCOMP) seems to be the cornerstone (Caena, 2019) which fosters lifelong learning:

> Personal, social, and learning to learn competence is the ability to reflect upon oneself, effectively manage time and information, work with others in a constructive way, remain resilient and manage one's own learning and career. It includes the ability to cope with uncertainty and complexity, *learn to learn*, support one's physical and emotional wellbeing, to maintain physical and mental health, and to be able to lead a health-conscious, future-oriented life, empathize and manage conflict in an inclusive and supportive context.
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> *European Commission, 2018 , p. 189/10*

The learning to learn competence can be fostered through self-regulated learning (SRL, hereinafter) practices with the aim of achieving self-assessment as a sustainable capacity (Boud, 2000). This implies that students are aware of their own learning and level of competence, understand how they can solve tasks and know which of their skills they must improve to cope with new learning situations (Cano, 2014).

It seems necessary to specifically place the learning to learn competence as a learning outcome to be achieved (Lluch & Portillo, 2018). To develop this competence, some strategies need to be carefully planned and implemented (Huang & Lajoie, 2021; Kizilcec, Pérez-Sanagustín, & Maldonado, 2017). One of these strategies is peer feedback (Tai, Ajjawi, Boud, Dawson, & Panadero, 2018). Therefore, planning specific peer-feedback activities following the rules of good peer-assessment practices (Panadero, Jonsson, & Strijbos, 2016; Rotsaert, Panadero, Schellens, & Raes, 2018) is related to the learning to learn competence (Van Den Boom, Paas, & Van Merriënboer, 2007). Specifically, peer feedback practices (Brooks, Carroll, Gillies, & Hattie, 2019; Topping, 1998) become an opportunity for students' engagement and the development of metacognitive strategies (Henderson, Ajjawi, Boud, & Molloy, 2019).

Moreover, these assessment and feedback experiences could be enhanced and transformed by digital technologies. Nonetheless, a review of the literature (Gros & Cano, 2021) reveals that technology is only used to support some steps of the process, such as offering quick information about solutions, providing automatic feedback or keeping and managing marks. The systematic review carried out by (Urbina, Villatoro, & Salinas, 2021) reveals a lack of evidence regarding SRL in digital environments. Consequently, the design of an intervention enhanced by technology with specific steps to foster SRL in the context of a complex task is still a challenge.

1.1 Peer Assessment to Enhance SRL

Self-regulation of learning (SRL), considered as the basis of other learning processes (European Commission, 2018), should be intentionally and systematically pursued.

Although there is ample literature on SRL processes in online environments (Berridi & Martínez, 2017; Broadbent, Sharman, Panadero, & Fuller-Tyszkiewicz, 2021; Delfino, Det-

tori, & Persico, 2010; Gibelli & Chiecher, 2012; Quesada-Pallarès, Sánchez-Martí, Ciraso-Calí, & Pineda-Herrero, 2019; Ribeiro-Ganda & Boruchovitch, 2018) , "faculty should not expect students to become better self-regulated learners simply from increased exposure to or experience with online courses" (Wandler & Imbriale, 2017, p. 6). Besides that, an analysis of the training programs implemented during the pandemic emphasizes the need to design sequences for SRL (Xie & Yang, 2020).

Consequently, feedback practices can be developed as a sustainable action: that is, understanding feedback as "the process through which learners make sense of the information they receive from different sources and use it to improve their work and/or learning strategies" (Carless & Boud, 2018, p. 3). These findings are verified in Hattie and Timperley (2007), who stated that the "where to next" category in feedback is identified by students as the most useful and most impactful on the quality of the next assignment. This 'actionable feedback' (Wood, 2022) needs to meet some criteria in order to be included in further learning processes. Among them, an active role of the student during the assessment process is suggested, instead of a passive role as a receiver of the instructor's feedback (W. Li & Zhang, 2021). In this way, Zong, Schunn, and Wang (2021) highlight what can make feedback more impactful on doing a task well: provided rather than received comments, longer rather than more numerous comments, and comments perceived to be helpful for revision.

Within the framework of 'Assessment as Learning' (AaL) (Boud & Molloy, 2013; Lee, 2017), students participate in external feedback processes to develop internal feedback (Nicol, 2020) which, in turn, encourages greater participation and responsibility of students in their SRL process. This occurs through the development of evaluative judgment, defined as "the ability to make decisions about the quality of one's own work and that of others" (Tai et al., 2018, p. 472).

Despite the differences in feedback experiences related to different disciplinary areas (Dawson, Carless, & Lee, 2021), feedback as a sustainable action (Lodge, Panadero, Broadbent, & Barba, 2019) must be promoted, according to the previous literature (Ajjawi & Boud, 2018; Butler & Winne, 1995; Carless, 2020; Carless, Salter, Yang, & Lam, 2011; Hattie & Timperley, 2007; Panadero et al., 2016), and linked to complex, competence-oriented, authentic and quality tasks (Ibarra-Sáiz, Rodríguez-Gómez, & Boud, 2020). Peer assessment seems a key strategy to promote self-evaluation and self-regulation of students (Tai et al., 2018).

There are several reasons why peer assessment has a positive impact on a student's learning process (Pons, Cano, & Forés, 2020). Firstly, to promote learning, it is also necessary for students to know assessment literacy skills. Assessment literacy is the process that allows students to understand assessment criteria and provide quality feedback and suggestions to enhance their learning process. It could be defined as the "processes of understanding the assessment process and applying this understanding to make academic judgments about one's work and performance" (Winstone et al., 2017, p. 25). Furthermore, peer assessment encourages the development of evaluative judgement because students must understand, appropriate, and apply the evaluation criteria to be able to assess the work of a peer. Secondly, one of the purposes of any learning process is that students develop their learning to

learn competence, for which it is necessary for the learner to be able to reflect on and assess their learning process to adjust it to specific needs and demands (Dawson et al., 2021). This implies developing evaluative judgement. Therefore, peer evaluation is not an end in itself, but a strategy to promote the self-evaluation and self-regulation of students.

There are two major conditions that can have an impact on peer assessment and feedback practices:

(1) The design of peer assessment needs to consider several variables in order to have a high impact. Topping (1998) defined a series of variables (Constellation variables) to be considered when designing and evaluating these experiences, some of them being: the purpose, the type of pairing, the approach, and the directionality, among others. Several studies have highlighted that receiving feedback improves task performance. Topping (2021) reviewed the proposal in order the complexity and the recursive sense of peer feedback to be strengthened. While providing feedback seems to enhance critical thinking and reflection (L. Li, Liu, & Steckelberg, 2010; Nicol, Thomson, & Breslin, 2014), maintaining both roles (assessor and assessed) in the designs seems interesting.

(2) The role of students, who must be actively engaged with the whole process, must also be taken into account. Understanding feedback as uptake means that feedback is the action that students undertake to make sense of the comments and use them to improve (Carless & Boud, 2018). In this way, the type of feedback provided and how the student reflects on and integrates the comments of the peer could affect the impact of this practice (Strijbos, Narciss, & Dünnebier, 2010). The careful design of learning loops for applying comments and, in some way, scaffolding reflection onto the learning process is to be welcomed.

1.2 Peer Assessment Supported by Technology

It seems that technology is still restricted to traditional teaching uses, with no reference to the importance of student agency for motivation, engagement, and deep learning (N. Winstone, Pitt, & Nash, 2021). The design of teaching supported by the systematic use of an LMS enhances effective learning outcomes (Sáiz, Marticorena, García, & Díez-Pastor, 2017). Thus, it is necessary to explore how SRL could be fostered within an LMS, as well as the processes of learning analytics for data tracing to monitor SRL processes (Winne, 2017). Nevertheless, it seems there is a lack of evidence on how environments enriched by technology can promote SRL. "Self-regulation in technology-enriched learning environments (TELE) presents many challenges, particularly in relation to students' commitment, motivation, social connection, and feedback. However, few research papers have been found on how various technological elements are related to these aspects" (Urbina et al., 2021, p. 9).

Spector et al. (2016) and Pinto and Leite (2020) consider that available technologies can help develop new practices related to critical thinking and solving complex problems and can improve performance. Consequently, the use of technology under the traditional teaching-learning paradigm should be superseded, as the use of clickers to maintain attention, gamified strategies to promote external motivation or online questionnaires to standardize and speed up grading processes do not imply a significant shift (Moreno, Jivet, Aljohani, & Gašević, 2021). The challenge is not about tools and technologies but, rather, about

pedagogy and achieving inclusive instructional designs in new learning environments and giving specific support to those who need it.

Some recent findings are hopeful. Knowing that the predictors of grades for online learners are: self-efficacy, time management, and effort regulation, and – to a lesser extent – for blended learners: self-efficacy and effort regulation, indicates that "assistance should be prioritized for those who lack confidence, do not manage their time well, and have difficulty persisting with tasks before engaging in a formative assessment task" (Broadbent et al., 2021, p. 7). This is how and where learning analytics should be used (Moreno et al., 2021).

2 METHODS

2.1 The Context of the Study

This paper corresponds to research that studies the effects of digital monitoring technologies on SRL. A peer-feedback intervention sequence was designed and applied in five degrees at the University of Barcelona during the academic year 2020-2021 (as a pilot) and 2021-2022, in order to consolidate more integrated and interdisciplinary research, as well as to ensure the viability of the project in all areas: Pharmacy, Archaeology, Management and Public Administration, Computer Engineering, Initial Teacher Training and Social Education. The research design includes pre- and post-test data on SRL from the Panadero, Broadbent, Boud, and Lodge (2019) questionnaire. In this section, the design of the integrated online intervention is presented.

2.2 Description of the Intervention

An SRL sequence embedded in a complex task was designed following Zimmerman's 3-phase cyclical SRL model (Zimmerman, 2001), asking students specifically about how to plan. It is aligned with feedback as self-regulation, which "leads to further engagement or effort invested in the task, to enhanced self-efficacy, and to attributions that the feedback is deserved and earned" (Hattie & Timperley, 2007, p. 102).

Students were also asked to engage in a peer feedback process, which is based on the model of Carless (2019) and considers the guidelines of Panadero et al. (2016).

Students should reflect on their own path, which comes from the logs of each online activity. An ad-hoc dashboard was created to improve the second version of the assignment (loop 2), as Timmers, Walraven, and Veldkamp (2015) suggested. The point of the intervention is to get students "to stop, reflect on their progress and change their strategy in one way or another", as Lodge et al. (2019, p. 6) stated.

The technological design was carried out in the institutional LMS (Moodle) with the "Personalized Learning Design" (PLD, hereinafter) and "Learning Analytics" (LA, hereinafter) tools. The institutional LMS was chosen as the common setting for all experiences, favouring scalability in large groups. PLD and LA have been considered as a source of information (external feedback) for students to transform it into internal feedback (Nicol, 2020). The functionalities that have been used are as follows:

2.2.1 Moodle Functionalities and LAs

2.2.1.1 Forethought and Planning Phase Moodle functionalities that were used:

- Presentation of the task (file).
- Forum 1 to discuss the task assessment criteria.
- Forum 2 to obtain a deep understanding of what good peer feedback means (enhancing assessment literacy).
- Open-ended questionnaire, writing goals, intermediate checkpoints and planning of the main actions to be undertaken.

LAs that were considered:

- Number of students downloading the task file; and which of them did so on a given date.
- Number of students participating in forum 1 and forum 2.
- Number of students consulting the attached resources posted in the second forum.
- Number of students completing the questionnaire; and which of them planned their task with a pass/fail assessment.

2.2.1.2 Performance Monitoring Phase Moodle functionalities that were used:

LOOP 1

- Task (version 1) delivered, and a peer feedback process applied in the Workshop tool.
- Forms to integrate changes.
- Questionnaire to explain the actions students intend to take in further versions of the task, as a result of the feedback given/received.

LOOP 2

- Task (version 2) delivered, and peer feedback process again applied in the Workshop tool.
- Forms to integrate changes again filled in.
- Questionnaire to explain actions again completed.

LAs that were considered:

- Access number to the Moodle Workshop tool.
- Date of access to the Moodle Workshop tool. .
- Number of students completing the questionnaire.
- Number of students answering the questionnaire to explain the actions they intend to take once the feedback has been integrated into their planning.

2.2.1.3 Reflection on Performance Phase Moodle functionalities that were used:

- Delivery of final version of the task with a reflection on how students' learning process has been enriched and what will be the next (feed-forward).

LAs that have been considered:

- Number of students producing a reflection with a pass/fail assessment in their planning.

2.2.2 PLD Settings

In addition to the above, the following PLD settings were considered in this experience:

- Activity completion functionality: allowing the student to see in the progress bar what % of the course activities have already been carried out.
- Conditioned activities: allowing the student to avoid performing an action if they have not previously completed a task. In our case, it has simply been linked to having downloaded the task.
- Alert system: allowing alerts to be sent to the student's email or appear in Moodle hours before the end of the activity or when the performance of an activity has not been satisfactory. In our case, an alert warning of peer evaluation process deadlines was activated in the first loop and bypassed in the second, so as to gradually remove the scaffolding from the SRL processes.

2.3 Validation Process

From this proposal, a validation process was designed before the start of the 2021-2022 academic year. Three dimensions were chosen for validation: the pedagogical sequence with the aim of promoting SRL; the effectiveness level of digital technologies, and the usefulness of specific Learning Analytics. All research and innovation procedures, as well as the University of Barcelona Code of Research Good Practices, were followed. Participation in the survey was voluntary, anonymous, and the research purposes became known to participants before providing consent. Informed consent was requested beforehand from all participants. The data are confidential and stored on secure devices.

2.3.1 Validation Process by Expert Judges

For each dimension, some subdimensions were defined to achieve more specific and detailed information on the initial version of the intervention, with the ultimate aim of introducing some improvements in the second version:

Pedagogical sequence with the aim of promoting SRL:

- Validity of the peer feedback sequence designed to promote SRL.
- Relevance of the conditions in which the performance of the task is required for SRL.

- Importance of the suggested reflections for the improvement of the next task and the SRL process.
- Intelligibility of the statements in the associated instruments.
- Viability of the proposal for further scalability.

Effectiveness level of digital technologies:

- Relevance of the specific Moodle tool selected.
- Characteristics with which the activity was configured.
- Restrictions or conditions for carrying out some activities.

Usefulness of specific Learning Analytics:

- Usefulness for the promotion of SRL (LA content).
- Technical and structural aspects (data usefulness, ease of interpretation of data for decision-making, dashboard attractiveness, etc.).
- Clarity of the embedding in Moodle.

2.3.2 Validation Process by Participating Students

For each dimension, some questions were defined to achieve more specific and detailed information about the initial version of the application of the intervention:

Pedagogical sequence with the aim of promoting SRL:

- Characteristics aligned with formative assessment, depending on the role (assessor or assessed).
- Usefulness for the promotion of SRL.

Effectiveness level of digital technologies:

- Characteristics aligned with formative assessment.

In this first application, there is no data about the usefulness of specific Learning Analytics, but these will be collected with the development of the dashboard during the next semester of the 2021-2022 academic year. However, we asked students about their overall satisfaction with the peer review experience.

2.4 Participants

Considering that it is an initial version of the intervention, an evaluation by expert judges was proposed. Three expert judges were selected for this validation (brief résumé of their expertise below), following some inclusion criteria: (a) Academics who are not involved in the research; (b) With a specific academic profile on the knowledge area (indexed papers and project leaders); (c) Associate professors who belong to a different higher education institution of the same territory, to ensure the scalability of the proposal at the regional level and (d) Accessibility or convenience sampling (being available for the research purposes).

1. Woman. Conducted research on SRL in Higher Education. Lecturer at the Universitat Autònoma de Barcelona. Conducting research on self-regulated learning in higher education.
2. Man. Conducted research on Moodle tools for learning in Higher Education. Associate professor at the Universitat de Barcelona. A trainer on an online assessment tool for university staff.
3. Woman. Conducted research on LA for SRL improvement. Associate Professor at the Universitat Oberta de Catalunya. Has led several papers and projects on learning analytics.

In addition, information was collected from the students who participated in the pilot experience of this intervention during the second semester of the 2020-2021 academic year (February-June). 448 students in total were enrolled in a subject related to: Pharmacy (57.38%), Archaeology (3.61%), Management and Public Administration (9.02%), Computer Engineering (13.10%), Initial Teacher Training (8.69%) or Social Education (8.20%).

2.5 Material and Methods

Validation sheets for the expert judges were created following these dimensions: the sheets had a quantitative section with a Likert scale, from 1-irrelevant aspect to 4-very relevant aspect, and a qualitative section with open comments for suggestions and strengths to be recorded. Quantitative data made it possible to calculate the global mean according to the experts. The open answers were classified into positive evaluation (to retain and to foster) and suggestions (to review and to avoid). This qualitative data was independently analysed by two members of the research team and finally put forward to reach a common understanding of each comment throughout the work meetings.

A questionnaire (of about 20 minutes duration) was created to collect data on students' satisfaction and perception of learning. This was administered by Google Forms and had 2 initial items with identification data (bachelor's degree and course). These questions had a quantitative section (26 items) with a Likert scale, from 1-disagree to 5-totally agree aspect, and a qualitative section (4 items) with open comments to justify the above answers.

3 RESULTS

This paper presents a specific didactic sequence supported by digital technologies through Moodle in order to promote SRL. This sequence was designed after a deep analysis of the theoretical underpinnings of SRL models and, in this section, the validation process by experts and participating students is shown.

3.1 Results of Expert Validation

After the validation process was undertaken, some changes were included in our sequence and technological tools. According to the theoretical framework on SRL and feedback stated for the design, and the coherence between SRL phases and design intervention steps (rated

with a mean of relevance: $\overline{x}$= 4 out of 4), expert 1 suggested the following: retaining the appropriation of criteria with students during the forethought and planning phase, and retaining the training on peer feedback to ensure a minimum "evaluative judgement", the peer assessment experience, and the final reflection in the performance phase. In addition, the participating expert suggested fostering some small training actions throughout the process of applying the criteria to an assignment already done, especially in annual subjects. Therefore, the expert suggested creating a gradation of the level of commitment to the criteria (from discussing them, to designing them), depending on the student's level. For example, regarding the peer assessment experience for students in the initial phases (first years), it could be useful to provide some type of rubric or pre-designed instruments, through which they can be allowed to narrate the changes in a more open format.

Additionally, regarding Moodle tools' functionality for the purposes of the intervention, and Moodle tools' usability (rated with a mean of relevance: $\overline{x}$= 3.88 out of 4), expert 2 suggested retaining the task statement file, forum 1 and forum 2 to set out and answer any queries, and the Workshop tool for the peer assessment process and its forms and questionnaires (in loop 1 and loop 2). Moreover, the final task with a reflection on how the students' learning process has been enriched and what the next one will be would be better if it were not necessary to share this final reflection with the other colleagues. Furthermore, the expert suggested creating a customized email (by PLD) to send the task statement file to each student. Moreover, if the queries (set out in forum 1 and forum 2) are too repetitive, it could be convenient to prepare an FAQ section for "frequent queries", with the advantage that these can be prepared in advance. Piloting this experience could allow, in the future, both production of a document of FAQs on the most common queries better adjustment of the educational sequence, since we will be more aware of the most common difficulties and may be able to design more accurate instructions and guidelines to develop a successful forethought and planning phase from the very beginning. Another possibility would be to remove forum 2 in order to create a Wiki that allows quick interaction without affecting the email notices generated by the forums. This option had been contemplated before, but this tool is only essential if it is collaborative work, and interaction can take place via the forum, which is a tool that students more familiar with. Finally, regarding the open-ended questionnaire to write goals and to plan the main actions and develop strategic planning for the task, the expert suggested that it would be useful to require a grade or present it through a task that allows greater flexibility in terms of feedback.

Finally, regarding the collected LAs for SRL (valued with a mean of relevance: $\overline{x}$= 2.83 out of 4), and the PLD rules used in the SRL framework (valued with a mean of relevance: $\overline{x}$= 3.33 out of 4), expert 3 suggested retaining the planned Moodle functionalities, the designed Dashboard and the planned PLD resources (activity completion functionality, conditioned activities, and alert systems), as they are aligned with the SRL framework, and they are coherent with the global sequence. Moreover, these resources are important to motivate students and to understand the didactic sequence designed, and the dashboard presents data that could be interesting for the class. Further to this, the expert suggested creating Open Digital Badges (ODB) in relation to Moodle functionalities. The expert also sug-

gested retaining qualitative information as peer feedback, but returning feedback in assessment assignments with grades or marks. The expert suggested presenting the data with a visual or actionable representation, which concentrates the SRL phases (the capacity that we would like to work with from the data), condensing basic variables. Another possibility that the expert proposed is to add completion to all tasks and to extend the alert system to other actions expected from the student. These last two aspects will be considered, keeping in mind that we aim to gradually offer greater autonomy to students. As such, having a high number of alerts could be perceived as external regulation, which would be counterproductive.

The final model includes the changes derived from the validation process and suggests a reliable intervention proposal supported by technology in an LMS (Moodle), which is transferable to a larger scale. The next challenge will probably be to adapt this sequence to the various levels of self-regulated learning – in the rubric that has been created as part of this project – that would be expected over time, as the degree courses progress, so that the scaffolding could be gradually withdrawn, and greater student autonomy shown. For that purpose, a longitudinal study following a cohort of students would be required.

The validations of the experts' judgements, with the elements to retain, to avoid, to create and to review, were considered in order to improve the design of the sequence during the 2021-2022 academic year. Apart from these validations, the perceptions of the participating teachers and students were considered. The first application of this sequence during the first semester of this academic year has also provided different adjustments from the participating teachers who were interviewed and from the students; one per degree was interviewed. Both suggested merging the two forums into one (Forum: Do you have any questions about the peer review task or process?), but with the condition of developing a dynamic in face-to-face classes for the appropriation of the criteria. In addition, they suggested including two more questions in the open-ended questionnaire (where students plan their goals and main actions), in order to reflect on the wording and meaning of all the assessment criteria and to consider what support their integration can bring to perform the task better.

Therefore, an improvement in the way the intervention and its components are developed is expected for the second semester of this course.

3.2 Results for Satisfaction and Perception of the Participating Students

A total of 143 students participated in answering the satisfaction and perception of learning questionnaire. Its analysis allows us to present different results, as can be observed hereafter. The first number refers to the mean of the role as assessor, and the second one to the mean of the role as assessed. Assessing the tasks of their classmates (that is, being the assessor) / Receiving the opinions, assessments and advice of their classmates (that is, being assessed) has allowed students to:

Rethink the objectives of the assessed task ($\overline{x}$= 3.6/3.77 out of 5); *Have a more critical view of the work I've done* ($\overline{x}$= 3.95/4.17); *Get more involved in my learning process* ($\overline{x}$= 3.81/3.95); *Be aware of the processes I need to improve in my learning process* ($\overline{x}$= 3.7/3.87); *Be aware of*

the processes I need to maintain and enhance in my learning process ($\overline{x}$= 3.7/3.65); *Contribute to the development of the learning-to-learn competence* ($\overline{x}$= 3.45/3.59); *Learn how to give feedback* ($\overline{x}$= 3.97/3.5); *Understand the evaluation criteria of the assessed task* ($\overline{x}$= 3.8/3.8).

From these results it can be interpreted that all means were above 3.5, and what was most helpful in the assessor role was learning how to give feedback ($\overline{x}$= 3.97) and to achieve a more critical view of the work ($\overline{x}$= 3.95). This was also the most valuable benefit of playing the role of assessed (Have a more critical view of the work I've done $\overline{x}$= 4.17), followed by getting more involved in their learning process ($\overline{x}$= 3.95).

Additionally,, the questionnaire investigated the usefulness of the promotion of SRL. Therefore, through peer review experience: *I have discovered strategies, skills or abilities that I could apply to other contexts* ($\overline{x}$= 3.4); *I have become aware of the actions and processes that can allow me to improve learning with more autonomy, efficiency and understanding in future tasks* ($\overline{x}$= 3.8); *I am able to represent the objectives, the evaluation criteria and the processes for planning and carrying out a quality assignment* ($\overline{x}$= 3.3); *I am able to self-assess the quality of my work* ($\overline{x}$= 3.7).

In terms of the effectiveness level of digital technologies, students indicated that, regarding the technological tool (Moodle functionalities that were used): *It makes it easier for me to give feedback to my peers* ($\overline{x}$= 4.0); *It makes it easy for me to access my partner's feedback whenever I want* ($\overline{x}$= 4.12); *I learn more than if the assessment was done on paper or orally* ($\overline{x}$=3.71); *It makes me feel more comfortable not having to tell colleagues directly how much I value their work* ($\overline{x}$= 3.43); *It makes it easier for me to have all the information in order and organized* ($\overline{x}$= 4.28). Finally, the overall satisfaction with the peer review experience was 4.02 (out of 5).

4 DISCUSSION

Achieving sustainable feedback requires the development of a new understanding of feedback in which students play the primary role (Boud, 2000). However some assessment literacy (N. E. Winstone et al., 2017) and feedback literacy is needed, as expert 1 and previous research stated (Carless & Boud, 2018). It is necessary to clearly explain the benefits of this process and to deeply understand the relationship between these practices, the CBA and the competence profile of the degree.

The assessment for learning benefits were already pointed out by Adachi, Tai, and Dawson (2017) from the teacher's point of view: the promotion of active learning and deeper understanding of standards, the development of soft skills or the possibility of an authentic assessment were, among others, the main positive aspects. To and Panadero (2019) analyzed students' perspectives and found that enriching understanding of quality, refining judgement and deepening self-reflection were the main benefits.

Some essential features of this experience are the following: to specifically put the learners at the center of this process by asking them to engage and empower themselves through their participation in the assessment process, to reflect on the received feedback (Strijbos et al., 2010) as well on the provided feedback, and to write down the main learnings for the

second version of the task.

More specifically, carefully designing a didactic sequence that could be adapted to different types of assignments and courses was necessary. The didactic sequence supported by technology shown here could support the development of complex tasks applying strategies aligned with SRL. Furthermore, the use of LA to support this process (Lodge et al., 2019) and the possibilities to provide scaffolded support to students who are at risk (Broadbent et al., 2021) without shifting to adaptive learning shows a promising future and a field worth exploring in higher education. Nonetheless, further research is still needed.

Following suggestions from the experts, the intervention sequence could be adapted to different levels. In the future, scaffolding will be considered, but it requires a longitudinal study, as other authors (Azevedo & Hadwin, 2005; Könings, Van Zundert, & Van Merriënboer, 2019; Panadero, 2017) have carried out. As part of this project, a rubric was created by some members of the team. Our first purpose was to adjust educational support to each level, but we cannot assume that students who are taking higher-level courses on their university degree have necessarily developed the SRL of a higher level of the rubric. Therefore, we have initially made an identical sequence for all years of the degree, but the results can allow us to adjust it according to the differences found along the way. Moreover, it should be considered that the development of SRL is individual and, therefore, there will be different levels in the same class regardless of the course. Different studies have previously worked on specific profiles in the use of learning and motivation strategies (Avila & Valarezo, 2020; Cueli, García, & González-Castro, 2013; García-Ripa, Sánchez-García, & Risquez, 2016). Considering their contributions would lead to more personalized proposals having first determining the level and profile of SRL to offer personalized support, as Broadbent et al. (2021) suggest. However, at the same time, this is a competence that must be acquired by everyone.

From the results regarding the students' perceptions, the decision was made to retain the peer review experience through Moodle as critical thinking (L. Li et al., 2010; Nicol et al., 2014) is enhanced by playing the assessor role and improvement of the task and the learning process are achieved through the role of the assessed if sustainable feedback is considered, Boud, 2000). Including activities to achieve a deeper comprehension of the tasks' objectives by discussing and/or voting on the importance of the criteria was also suggested. Engagement with the assessment criteria for the specific task (Dawson et al., 2021) as well as for the peer review (Panadero et al., 2016; Rotsaert et al., 2018) were strengthened using a video and an infographic poster created ad hoc.

5 CONCLUSIONS

It is important that SRL becomes intentionally pursued and, therefore, becomes a specific learning outcome embedded in subjects, to guarantee that a minimum level of competence is achieved by everyone who has passed a higher education course. For this reason, a longitudinal study following a cohort of students would be required in order to obtain a deep understanding of how SRL grows and how peer and self-assessment experiences supported

by LA become successful strategies to develop evaluative judgement and achieve SRL. The key is "monitoring, directing or action, nudging students towards adopting different strategies rather than attempting to provide specific feedback or advice" (Lodge et al., 2019, p. 7).

The next challenge will probably be to adapt this sequence to the various levels of SRL that would be expected over time, as the degree courses progress, so that scaffolding could be gradually withdrawn, and students could progressively have greater autonomy.

This is an important aspect as it implies some inconsistency: trying to get students to self-regulate by prescribing everything. Therefore, despite the fact that scaffolding is necessary, removing it is also very important in order to develop autonomous students with true evaluative judgment. For this reason, the results of the application of this design, both in terms of increasing SRL and in terms of the perception of the stakeholders, can be very useful.

Regarding the theoretical framework, the first constraint comes from the definition and measurement of the "Learning to Learn competence". This difficulty was overcome by assuming that the competence is SRL in action but there is not enough previous research to support this, and the research could be affected by this decision. The second one is due to following Zimmerman's model. As Panadero (2017) states, there are different models of SRL, and the classical proposal of Zimmerman does not sufficiently consider either the emotional dimension (Boekaerts, 2011) or social collaboration contexts (Panadero & Järvelä, 2015). Finally, under Zimmerman's cyclical model of SRL, the phases of forethought, performance and reflection could be promoted throughout several strategies. Peer feedback is only one of these strategies. Focusing on these could place other influencing strategies at a secondary level.

One of the limitations stems from the small amount of data obtained only by the judgement of three experts and 143 students. Despite this, modifications have been made and the intervention will be implemented with the revised design. The first cycle will allow both objective data and satisfaction data to be collected in order to apply, if necessary, new adjustments both to the didactic sequence and to the Moodle tools used and to the LAs collected and displayed.

6 AUTHORS' CONTRIBUTIONS

Elena Cano García: Conceptualization, Validation, Investigation Writing – Original Draft, Writing – Review & Editing, Supervision, Project administration, Funding acquisition; **Laia Lluch Molins:** Methodology, Software, Formal analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization. **All authors** have read and agreed to the published version of the manuscript.

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