Studies in Educational Evaluation 83 (2024) 101407

Contents lists available at ScienceDirect

Studies in Educational Evaluation

journal homepage: www.elsevier.com/locate/stueduc

Self-regulated learning in secondary school: Students' self-feedback in a peer observation programme

Ana Cristina Torres [a,*,1,2], Marina Duarte [b,3,4], Daniela Pinto [a,1,5], Ana Mouraz [c,6,7]

[a] CIIE - Centre for Research and Intervention in Education, FPCEUP - Faculty of Psychology and Education Sciences of the University of Porto, Portugal
[b] ISEP – School of Engineering, Polytechnic of Porto and CIIE - Centre for Research and Intervention in Education, FPCEUP - Faculty of Psychology and Educational Sciences of the University of Porto, Portugal
[c] LE@D - Laboratory of Distance Education and eLearning, Open University, Portugal

ARTICLE INFO

Keywords:
Observational learning
Student-centred learning
Peer observation
Feedback
Self-regulation

ABSTRACT

Self-regulated learning (SRL) is crucial for fostering learner autonomy and lifelong learning skills. The article focuses on observation as a trigger of student self-feedback and self-reflection towards the development of SRL. A student peer observation programme, co-designed and piloted by teachers and researchers in two Portuguese public secondary schools is introduced, including its theoretical and methodological framework, observation scheme, and supporting observation guides. A qualitative study of self-reported effects by participating students was performed with the objectives of identifying strong aspects and possible improvements to the programme but also to gain a deeper understanding of how observation and self-feedback mediate between the performance and self-reflection phases of SRL. The results reveal an increased appreciation for feedback from various sources, and of the reflection it enables, with students emphasizing seeking help from teachers and peers. Implications for designing collaborative and student-centred learning environments with observational strategies to promote SRL are included.

1. Introduction

Self-regulated learning (SRL) is increasingly recognized as an essential driver of learner autonomy and a valuable competence in lifelong learning. The OECD Learning Compass 2030 (OECD, 2018a) highlights self-regulation as a transformative competence that "involves self-control, self-efficacy, responsibility, problem-solving and adaptability" (p. 6). In convergence, European policies list "learning to learn" as a key competence for lifelong learning (EC – European Commission, 2019), highlighting the importance of developing knowledge in "one's preferred learning strategies, (…) development needs and various ways to develop competencies and search for the education, training and career opportunities and guidance or support available" (p. 11).

In educational psychology, SRL has been widely explored as an essential mediator of learning, comprising cognitive, metacognitive, motivational and emotional aspects in learning processes and experiences (Panadero, 2017). However, since the very early social-cognitive conceptions of SRL (Zimmerman, 2000), its interplay with social contexts has also been highlighted in self-regulation processes. Moreover, the expansion of such perspectives considering situated learning has led to the valuing of shared knowledge and collaboration in more social forms of regulation such as shared regulation and co-regulation (Hadwin et al., 2018) which interact with SRL. As such, alongside the development of theoretical models of self-regulation to emphasize the interplay

* Corresponding author.
E-mail addresses: acctorres@fpce.up.pt (A.C. Torres), mic@isep.ipp.pt (M. Duarte), danielapinto@fpce.up.pt (D. Pinto), Ana.Lopes@uab.pt (A. Mouraz).
[1] Postal address: Faculdade de Psicologia e Ciências da Educação da Universidade do Porto, Rua Alfredo Allen, 4200–135 Porto, PORTUGAL
[2] ORCID: https://orcid.org/0000–0002-9068–1203
[3] Postal address: Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4249–015 Porto, PORTUGAL
[4] ORCID: https://orcid.org/0000–0002-3153–3251
[5] ORCID: https://orcid.org/0000–0002-8867–4733
[6] ORCID: https://orcid.org/0000–0001-7960–5923
[7] Postal address: Universidade Aberta, Rua Almirante Barroso, 38, 1000–013 Lisboa, PORTUGAL

https://doi.org/10.1016/j.stueduc.2024.101407
Received 22 December 2023; Received in revised form 27 August 2024; Accepted 30 September 2024
Available online 14 October 2024
0191-491X/© 2024 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

of its multidimensional variables (Panadero, 2017), research has focused on how models of self-regulation should inform the design of learning environments and interventions. A review by Panadero (2017) emphasized a cyclical model of SRL (Zimmerman & Kitsantas, 2005) as a developmental approach which is particularly beneficial for learning. This cyclical model of SRL skills development, which has been improved over the years (Zimmerman, 2000; Zimmerman & Moylan, 2009), includes the cyclical phases of forethought, performance and self-reflection, and points to the importance of practice, feedback, and observation to ignite cyclical adjustments between these phases. Zimmerman (2000) also proposed a multilevel model of how one becomes a self-regulated learner, from observation (level 1) to emulation (level 2), self-control (level 3) and self-regulation (level 4), which has gathered a great deal of supporting evidence and improvements over the years (Panadero, 2017). Feedback has a crucial role to play between these levels of SRL development. However, research has mostly focused on teacher or peer feedback, and less on self-feedback, that is, feedback students produce from observing others or doing self-evaluation.

The present article focuses on the potential of observational processes as a trigger of student self-reflection and, ultimately, the development of self-regulation skills. Observational learning occurs naturally in learning settings through modelling and is essentially related to communication and collaboration processes which are in constant change due to rapid technological advances (Bandura, 2004). Modelling is an important process in SRL (Dignath & Veenman, 2021; White & DiBenedetto, 2015). As Nicol (2021) highlighted, observation of peers' work in terms of performances and results is a crucial natural process for students to regulate their performance, since comparison of performance triggers internal feedback on how to improve it. However, the deepening of how observing role models performing a task (e.g., a teacher, a tutor, a peer, a simulation) stimulates self-feedback which is conducive to reflection and SRL has mostly been restricted to specific disciplinary performances such as music (e.g. Mieder & Bugos, 2017), sports (e.g. Zimmerman & Kitsantas, 2005) and language proficiency (e.g., Zimmerman & Kitsantas, 2002), and less with regulating wider learning strategies such as communicating and supporting in group discussions (Tamura & Uesugi, 2020). Other research has explored observational processes in peer assessment and their relation to self-assessment as a crucial process for SRL development (Panadero et al., 2016). In most of these cases, peer observation is implicitly embedded in group work or peer assessment and connected to fostering specific disciplinary competencies. On the other hand, a more explicit view on peer observation devices has mostly been circumscribed to teachers and for improving teaching practices in higher education (e.g., Mouraz, & Ferreira, 2021; Nguyen, 2020; Shortland, 2010) and in schools (e.g., Mouraz, Pinto, & Torres, 2022; Visone, 2019), with discussions on how observation can be guided to support effective feedback and reflection for improving teaching (Eriksson, Boistrup & Thornberg, 2018; Molloy & Boud, 2014). This study rests on the assumption that guided peer observation among students can be an important device for promoting peer and self-feedback, improving learning strategies which are transferable to different disciplinary settings.

This study included a programme of peer observation between students, co-designed by a team of teachers and researchers with wide experience in collaborative engagement in peer observation of teaching (e.g., Mouraz, Pinto, & Torres, 2022) and an investigation of the self-reported effects on participating students' self-regulation skills. The programme consisted of an observation scheme, with two cycles of observation and each having a pre, during and post observation task, that was co-designed by teachers and researchers along with supporting guides and was piloted in two public schools in the same locality in Portugal during the academic year 2019/2020. The aim was to raise observers' self-awareness of different learning strategies, as well as learning barriers and facilitators, thus increasing self-reflection about learning processes and improving self-regulation. Eight students from grade 9 (ages 14–15) and eight from grades 11 and 12 (ages 16–18) observed their peers in the classes of the eight participating teachers, focusing on their colleague's performance of the teacher-assigned learning tasks and interactions with teacher and peers during class activities.

The article proposes to introduce the programme's theoretical and methodological framework, the observation scheme, and its supporting observation guides, and to discuss its strong aspects and those for improvement considering reported effects by participating students and teachers. The implementation of the programme was monitored by means of a cross-analysis of the open-ended questions of observation guides and of questionnaires completed by participating teachers and students. Thematic analysis was performed on the students' answers to open questions in this material, responding to the following question: *How do students regulate their own learning by observing their peers in the performance of a task?* To answer this research question, we organized the analysis around the following questions: Q1) What difficulties in engaging with learning tasks do students identify observing their peers?; Q2) What strategies to overcome difficulties do students recognize while observing their peers?, Q3) What self-feedback do students produce about what they must do to overcome identified difficulties?; and Q4) What changes do students recognize in their own engagement with learning tasks from observing and reflecting upon their peers' strategies?

Assuming that observation can be an important mediator between the performance and the self-reflection phase of SRL (Zimmerman, 2000), we were mostly interested in gaining greater depth of understanding of how observing students reflected upon their observed colleagues' approach to the learning task they were assigned, particularly in terms of difficulties experienced and strategies employed to overcome those difficulties (performance), as well as changes in their own behaviours as a result of experiencing these observations (self-reflections).

2. Theoretical framework

2.1. Self-regulated learning: the mediating role of observation and reflection

Self-regulated learning is inherently linked to the presence of others, even if the influence of others may be fluid or indirect. Considering this, it is crucial to investigate the studied connections between SRL, observational processes and the reflections they promote.

Utilizing Zimmerman's model (2000) as a foundational framework for this exploration reveals that SRL is initially delineated into three phases: forethought, performance, and self-reflection. In the updated cyclical model, Zimmerman and Moylan (2009) identified strategies and categorized them according to these three phases. For instance, task analysis and strategic planning are proposed in the forethought phase. In the performance phase, self-control and self-observation are employed through adjusting aspects such as task strategies, time management, help-seeking or environmental structuring. Lastly, the self-reflection phase involves self-evaluation and self-feedback, causal attribution and considering adaptations to a new cycle of learning. According to the authors, the cycle leaps between forethought, performance and self-reflection are moved by the feedback which learners receive from social (e.g. a peer, a teacher) or personal (e.g., physiological outcomes, behavioural outcomes) sources. As such, learners become progressively more able to tackle barriers to learning such as avoiding help-seeking or difficulties in time management (in the performance phase), every time they produce or receive feedback that moves them to self-reflection strategies such as self-evaluation, and forethought strategies, such as task analysis.

Furthermore, while the model is presented as a tool for individual use, it is apparent that these strategies are not feasible without a social context that establishes criteria and aids individuals in discovering their forethoughts and defining criteria for performance and self-reflection.

The social context in which the SRL model develops is predominantly

shaped by teachers who regulate the pace of learning by demonstrating and verbalizing regulatory actions and thoughts. The teacher's role is underscored as pivotal, serving as a model and monitor of students' behaviour (Dignath & Veenman, 2021), as also highlighted by White and DiBenedetto (2015), particularly concerning the scaffolding work of teachers in observational learning guidance. The SRL model achieves its objectives when students intentionally practice the application of regulatory strategies, initially under the supervision of their teachers, with the gradual fading of this scaffolding (Perry & Rahim, 2011).

Hence, in the performance phase, students endeavour to replicate the behaviours demonstrated by their teacher or peers. The interplay between modelling and observation is integral to proficiently adopting a learning strategy. In the self-reflection phase, students scrutinize their behaviour, enabling them to systematically adapt their learning to evolving requirements and conditions. At this point, the teacher can create a learning environment that empowers students to operate without constant supervision, intervening only when assistance is sought (Zimmerman, 2000).

In another study by Zimmerman, variations in SRL between proactive and reactive students were examined more thoroughly, leading to the conclusion that:

> Students' development of self-regulatory competence has been studied from a multilevel social cognitive perspective, and there is strong evidence that people who learn vicariously from self-regulatory models and adapt the model's techniques to their own personal functioning are more successful and better motivated than individuals who rely on asocial self-discovery. (Zimmerman & Kitsantas, 2002, p. 660)

The role of peers in such learning environments is paramount, given that learning unfolds within a social and collaborative landscape. SRL encompasses individual learners' intentional and strategic metacognitive planning, task execution, reflection, and adaptation within a shared task. It entails individuals assuming personal responsibility through the continuous refinement of cognitive, behavioural, motivational, and emotional conditions as required. These conditions primarily emanate from the classroom or the belonging group, serving as the context for self-adaptation. Consequently, SRL both shapes and is influenced by personal and group-based beliefs, experiences, the environment, and collaborative task engagement.

As a result, there is a growing perspective advocating that individual self-regulation in the service of group tasks is essential for enhancing productive collaboration. Indeed, Hadwin, Jarvela, and Miller (2018) concluded that evidence of SRL during collaboration complements the emergence of shared regulation. From this perspective, various studies in several scientific fields have highlighted the potential of collaborative work among students as an effective tool for the development of Self-Regulated Learning (SRL) (Moura et al., 2024; Fernandez-Rio, Cecchini, Méndez-Gimenez, Mendez-Alonso & Prieto, 2017). Collaborative interaction allows students to share strategies, discuss problem-solving approaches, and collectively reflect on their learning practices, which can strengthen SRL by encouraging metacognition, autonomy, and responsibility in the learning process. Additionally, the collaborative environment fosters a culture of mutual support, where students can observe different methods and receive continuous feedback, enhancing their ability to adjust learning strategies and goals. Although some studies have explored the relationship between peer observation and learning in higher education (e.g., St-Onge, Martineau, Harvey, Bergeron, Mamede, Rikers, 2013) there remains a significant gap in the research that directly links SRL with peer observation, particularly within the context of primary and secondary education. In this study, we aim to explore this relationship and increase scientific knowledge about the potential contributions of peer observation to the development of SRL.

3. Methods

For the study, a design research approach (McKenney, Nieveen, & van den Akker, 2006) was adopted for its potential to support the development of effective educational interventions while offering opportunities to produce design principles, resources and professional development of the participants involved. The design research approach involves cyclical phases of analysis, design and evaluation. Here we introduce the pilot programme of peer observation. We start with context and participants and challenges they face. Afterwards, we explain our shift from a focus on teaching to a focus on learning and detailing the programme's main implementation features. We then present how we collected data to evaluate the programme and how we performed our data analysis to respond to the research question.

3.1. The analysis phase: background, context and participants

After six years of implementing a multidisciplinary peer observation teaching programme for pedagogical supervision, we have gained valuable insights and experiences. Our findings confirm that this methodology effectively promotes incremental changes in classroom practices, leading to more innovative and student-centred teaching approaches (Mouraz, Pinto, & Torres, 2022). Inspired by the enthusiasm of participating teachers and the curiosity of their students, our research team was challenged by students to design a programme that incorporated the perspectives of students as observers of class situations. Our analysis with teachers of their students' difficulties and of the potential of peer observation for students led us to shift the focus of the peer observation scheme to student learning and emphasizing SRL. For this purpose, we also associated a device to promote student self-feedback.

The programme was implemented in two school clusters, respectively A and B, located in a predominantly urban area of northern Portugal. School clusters in Portugal are groups of schools at different educational levels within the same geographical area, operating under a common mission, educational project, and management team. School cluster A comprises eleven schools spanning preschool to upper secondary education (ages 3–18). It accommodates approximately 3400 students guided by 337 teachers. This cluster demonstrates satisfactory educational success, with higher average student grades in all subjects during the third cycle of basic education compared to the national average. In upper secondary education, average student grades are below the national average in some subjects, but school dropout rates remain minimal.

School cluster B consists of seven educational establishments catering to preschool through grade 9 (ages 3–15), with approximately 1700 students and 93 teachers. This cluster exhibits high levels of student success in both internal and external assessments, surpassing national results. School dropout rates are also negligible. However, the cluster faces challenges such as declining student enrolment, socio-economic disparities among households, and weaknesses in physical infrastructure.

In this pilot programme edition, 16 students participated, observing the classes of eight teachers. Among the students, eight are from grade 9 (third cycle of basic education), while the rest are from grades 11 and 12 (upper secondary education). The student observers, aged 14–18, consist of 10 males (three from grade 9 and seven from upper secondary education) and six females (five from the grade 9 and one from upper secondary education). As for the teachers, four teach in the third cycle of basic education and four in upper secondary education, with each group comprising three female teachers and one male teacher. Their subject areas vary, including mathematics, Portuguese, natural sciences, physical education (for basic education teachers), and mathematics, Portuguese, biology, and informatics (for upper secondary education teachers). This diversity in teaching levels and subject areas is crucial for understanding the self-regulation strategies employed by students across different levels and disciplines.

3.2. The design of the programme of peer observation among students in the classroom

In 2019, the team designed a scheme of peer observation amongst students, which was implemented in an experimental phase during the academic year 2019/2020. The design process operated under the assumption that peer observation among students with feedback to peers and teachers can enhance students' SRL skills by fostering self-reflection and amplifying their influence in the pedagogical improvement of teaching practices. The programme, including the observation scheme and the observation guides, challenged students to observe their peers' engagement in teacher-assigned learning tasks during class activities. As such, the observation of peers was an additional learning task to observing students within teacher-assigned class activities. The primary goal was to enhance observers' awareness of various learning strategies and different approaches to overcoming potential challenges in solving teacher-assigned tasks. Additionally, this initiative aimed to foster increased student participation in the improvement of teaching practices.

Each participating teacher was asked to choose two students from each class group to participate as observers in the pilot programme. To support this selection, the researchers engaged in discussions with the teachers of the selection criteria for students to be observers, but left the final decision to the teachers' discretion, with the assurance that the participation of students in the process was consented to and informed. Some of the factors that were jointly analysed had to do with students being willing to participate, students showing a particular need to develop autonomy, or being less participative. Moreover, the integration of the observation and feedback process within the class activities was entirely up to the teachers who exercised their agency in developing this programme as a pedagogical activity.

After selecting the observers, the next step involved pairing each student with a class of the same subject, same teacher, and same classroom, but at different moments: the first and second observation cycle. During each cycle, the students documented their observations of the lesson using a guide that established the focus of the observations on difficulties experienced and ways to overcome them, but also facilitated the observation process, feedback and subsequent reflection.

As for implementation of the programme, participating teachers attended a session with the researchers where the programme's objectives, operation, observation guidelines, and key concepts such as SRL and student voice in improving educational practices were proposed and co-designed with the teachers. After reaching consensus on the proposal, sharing the proposal with the previously identified students, and getting their consent to participate, the observation phase consisted of two cycles, with students observing classes and completing observation guides for each session, in a scheme illustrated in Fig. 1. The first cycle predominantly took place in the physical classroom (February 2020), while the second cycle mainly occurred in the online classroom environment

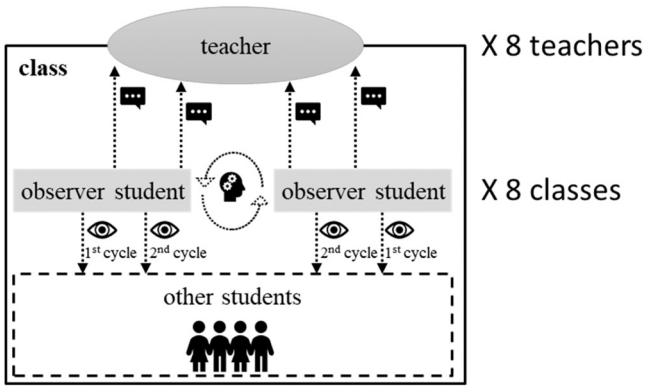


Fig. 1. Scheme of peer observation among students.

(May and June 2020) due to the pandemic-induced school closures. Following the completion of observations, questionnaires were administered online to both students and teachers to gauge self-reported effects.

3.3. The evaluation of the programme: data collection and analysis

We used two sets of data collection methods to monitor the intervention. Firstly, the students filled out an observation guide in class both during and immediately following the observation events. Additionally, the students completed in class an online questionnaire after their participation.

The observation guide included three key question groups (see Appendix A). The initial set captured details about the observing student, such as gender, age, school year, and characterization of the observed class (cycle, subject, and date). The second group of questions concerns the students' approach to the proposed tasks, with questions based on task strategies of the forethought and performance phases (Zimmerman, 2000; Zimmerman, & Moylan, 2009), such as time spent on strategic planning, help-seeking and environmental structuring. This section prompted the observing student to outline the observed tasks and indicate their perception of how many of their peers (4-point scale: some, half, most, all): (1) started immediately to perform the task, (2) asked the teacher for help, (3) asked colleagues for help, or (4) used the textbook, notebook or other notes to get support in performing the assignment. The third group comprised three open-ended questions. Here, student observers were encouraged to identify their colleagues' difficulties and ways to solve them, as well as contemplate how they would address these same challenges if faced with them. These open queries, inspired in task strategies from the self-reflection phase (Zimmerman, 2000; Zimmerman, & Moylan, 2009) aimed to foster self-feedback among student observers as a trigger of self-reflection, prompting them to consider their engagement with learning tasks and gain insight into their own learning styles and abilities.

Due to the COVID-19 pandemic and the shift to distance learning, our observation guide needed restructuring (see Appendix B). Originally designed for in-person classes, it had to be adapted for online settings, moving from paper to a digital format via a Google form. Understanding the diverse formats in distance learning, we added a question about the type of activity observed (e.g., video conferences or online tasks). The nature of student–task interactions in distance learning settings differs, so we revised the guide to focus on other crucial relationships. Instead of quantitative questions, we delved into students' interactions with teachers and students, their motivation, and the challenges faced. To capture this complexity, response options expanded to offer a more nuanced view. The revised options now included: all students, more than half, about half, less than half, or none.

In addition to observation guides, we administered an online questionnaire to students after the programme to understand their perspectives on strong and improvement aspects of the programme and assess the programme's effects on their SRL. Originally planned as a focus group discussion, the questionnaire shifted to a web-based format due to the pandemic's distance learning context. Despite potential methodological limitations such as low response rates (Creswell, 2012), this method became necessary for access to students. We took precautions in the construction of this questionnaire to increase the number of responses and enable the expansion of the students' perspectives, namely: a) all questions were open-ended to encourage reflection, b) the questions were creatively formulated to engage the students, c) it was designed to guarantee anonymity and promote honesty, and d) the questionnaire was administered by the teachers to obtain potentially higher response rates due to their closer relationship with students than researchers.

In designing and applying the questionnaire, we followed Creswell's (2012) advice on how to construct good questions that help participants provide meaningful answers. We prioritized creating questions that

motivated participants to engage actively.

Hence, the questionnaire was organized into three question groups (see Appendix C). The initial set aimed to profile respondents and their engagement in the programme, comprising inquiries about gender, age, education level, and the type of observation (in-person, online, or both). The second set focused on understanding students' perceptions of their participation in the programme. It featured an initial question prompting respondents to identify three words associated with their involvement. This group included three more questions asking students to complete the following sentences: "The best moment of my participation was …"; "A good surprise in my participation was…" and "The most difficult part of my participation was …". The final group aimed to understand the students' perceptions about effects of participating in the programme, namely fostering a self-evaluation of own learning strategies and causal attribution, as suggested in Zimmerman's model (2000) for the self-reflection phase. This group included two questions in which respondents were asked to complete the following sentences: "Because of doing peer observation, during classes, I started trying not to…" and "Because of doing peer observation, during classes, I started to work harder for…". In each of these sentences, students were also asked to justify how they completed them. This group also included a last question that intended to understand the importance which students attributed to participating in the programme.

Additionally, to encourage student participation, we utilized a word cloud on the programme's website. This display of words associated with the project by their peers not only attracted more responses from those who had not participated but also served to share the obtained results with all participants.

Throughout the data collection process, ethical conditions were ensured. All activities related to peer observation and feedback, as well as the completion of observation guides and questionnaires, were conducted within the classroom context and integrated into the teachers' pedagogical strategies, who mediated the entire process. Students and their guardians were informed by the teachers about the use of this observation model as a pedagogical strategy and its use for research purposes. The researchers did not have access to the students' identities, or any confidential information related to them.

Given the qualitative nature of the responses to the applied instruments (guides and questionnaires) and the focus on the students' discourses in the feedback provided, we decided to perform thematic analysis. With strong roots in qualitative psychology (Braun & Clarke, 2006), thematic analysis has been demonstrated to be "an accessible and flexible method to analyse qualitative data collected in the natural classroom setting" (Xu & Zammit, 2020, p. 2). Braun and Clarke (2006) argued that most qualitative analyses are thematic in their essence since they involve "identifying, analysing, and reporting patterns (themes) within data" (p. 79). With a concern for highlighting students' perspectives in combination with existing theory on feedback and SRL, we used thematic analysis to resonate with this constructivist approach and allow for the combination of inductive and deductive coding (Xu & Zammit, 2020).

Themes emerged from patterns in students' perspectives from observing their peers that can be explained by previous research on SRL and peer feedback with other research methods.

To respond to our main research question: *How do students regulate their own learning by observing their peers in the performance of a task?,* we started posing four secondary research questions to better organize our data analysis:

Q1 – What difficulties in engaging with learning tasks do students identify when observing their peers?

Q2 – What strategies to overcome difficulties do students recognize while observing their peers?

Q3 – What self-feedback do students produce about what they must do to overcome the difficulties identified?

Q4 – What changes do students recognize in their own engagement with learning tasks from observing and reflecting upon their peers' strategies?

These questions are closely related to the concepts of reflection, self-feedback, and self-regulation. Q1 reveals the challenges identified by students in their peers, fostering an examination of their own experiences and perceptions upon obstacles to learning. Q2 seeks to explore the students' recognition of effective strategies for overcoming difficulties, a central aspect of self-regulation that involves adjusting approaches and behaviours based on observations and experiences. Q3 delves into the impact of students' self-feedback aimed at enhancing their learning. Moreover, it aids in pinpointing the self-regulation strategies employed by students to confront specific challenges during the development of learning tasks. Finally, by reflecting on their peers' strategies, students recognize changes in their own engagement with learning tasks. This recognition involves both reflecting on their own behaviour and the ability to self-regulate by adjusting strategies based on observations and reflections, a process explored through Q4. The answer to these questions converges in obtaining results that enable an understanding of how the processes of self-regulation of students' learning are structured through peer observation.

Addressing these questions will facilitate the systematic organization of data, capturing distinct phases in the evolution of observation, reflection, feedback, and self-feedback – integral components in addressing the main research question.

The deductive coding of thematic analysis is intricately tied to the way in which the questions in the observation guides and questionnaires shaped the organization of the analysis. Consequently, the initial phase of data analysis involved filtering the data through the thematic lenses presented in the student inquiries. As such, to answer Q1, we focused our analysis on the answers to question 3.1. in both versions of the observation guide; to answer Q2, our analysis included students remarks on question 3.2. in both versions of the observation guide; to answer Q3, we mostly analysed answers to question 3.3. in both versions of the observation guide; and finally, to answer Q4, our analysis focused on answers to the questions on the group 3 – reflections on the effects on self-regulation (3.1. to 3.5.) of the online questionnaires. These themes served as overarching dimensions around which the subsequent categories were structured. Drawing upon Braun and Clarke's (2006) approach to thematic analysis, we started to *familiarize ourselves with our data* by reading through the data from the guides and the students' questionnaires that we had in Excel files. The relation between responses in different fields was detected, initial ideas were noted about the students' responses and it was decided which fields of responses were going to be coded to better respond to our secondary research questions. Afterwards, we *inductively generated initial codes* for each response field and used students' discourses as much as possible (e.g., "lack of knowledge of important concepts", "methodology of resolving the exercise", "I would be more attentive in the next class"). Then we searched for patterns in the codes to *identify themes* that were more adequate to respond to our secondary research questions. At this stage, we used NVivo software to support us in the analysis. With these themes, we generated an initial table of themes (Table 1). Afterwards, we analysed this table and *reviewed the themes* to check for consistency with the coded data, but also its validity when looked upon against other fields of the dataset that described contextual features of the observation. At this stage, we also

Table 1
Distribution of observations by school, observation cycle and type of class.

School	1st cycle of observations		2nd cycle of observations	
	In-person classes	Distance learning classes	In-person classes	Distance learning classes
School A	8	0	2	2
School B	2	6	0	8
Total	16		12	

ascertained other relations between different themes that were not so apparent in the initial coding process. Then after comparing our data with theory, we reached a final consensus on the *definition and naming of the themes*, producing the final thematic map in Fig. 2 in which the size of each theme's box represents the relative prevalence of identified themes. This map is analysed and discussed in the findings section according to our research questions.

4. Results

4.1. Responses' overview

We collected a total of 28 observation guides from the observers, distributed as shown in Table 1 according to the school, observation cycle and type of class in which they took place.

In-person class observations were evenly distributed between mathematics and computer systems programming (33 % of the total). For distance learning classes, observations were divided equally among natural sciences, mathematics, and Portuguese (29 % of the total each). Physical education accounts for 14 % of the cases in observation guides. All the students referred to the observed activities as easy and motivating or having an appropriate level of challenge in an open answer question. Moreover, positive interactions between observed students were also noted.

Regarding activities in distance learning classes, the predominant observation (86 %) involved classes conducted through online platforms like Zoom or Google Meet, with a smaller percentage reporting student collaboration (7 %), or tasks on platforms such as Google Classroom. Almost all students reported an easy or adequate level of difficulty and that the activities were motivating or challenging, but interactions or collaboration between students were generally referred to be reduced.

Regarding the student questionnaire, we received 14 responses, resulting in an 87.5 % response rate, achieved through strategies to enhance student engagement. Table 2 below shows the profile of the participants.

Table 2
Profile of the participants.

Variables		N
Gender	Female	6
	Male	8
Age	14 years old	4
	15 years old	4
	16 years old	2
	17 years old	3
	18 years old	1
Educational levels	3rd cycle of basic education (students aged 12–15)	8
	upper secondary education (students aged 15–18)	6

Regarding the type of observation utilized during the programme, considering the adjustments due to the shift to distance learning resulting from the COVID-19 pandemic, which led to a blend of face-to-face and online observations, we found that three respondents solely conducted face-to-face observations. In contrast, eight observed online classes, and three engaged in both in-person and online observations. Hence, contrary to the initial plan, most of the observations occurred within the distance classes.

4.2. Students' reflections on self-regulation from observing their peers

This work is mostly focused on students' self-reported effects of participating in a peer observation programme in class. We performed an inductive thematic analysis of students' responses in the observation guides used in the observation sessions and in the final questionnaires that resulted in an initial list of themes and subthemes. The first thing to note in these themes is that it was not possible to have references to exclusive codes since students sometimes reported different layers of difficulties in the same answer and other times they reported sequences of different strategies for trying to overcome experiences or their own difficulties which reflects a thorough self-reflection about their own learning strategies.

A first theme related to observed difficulties and identified

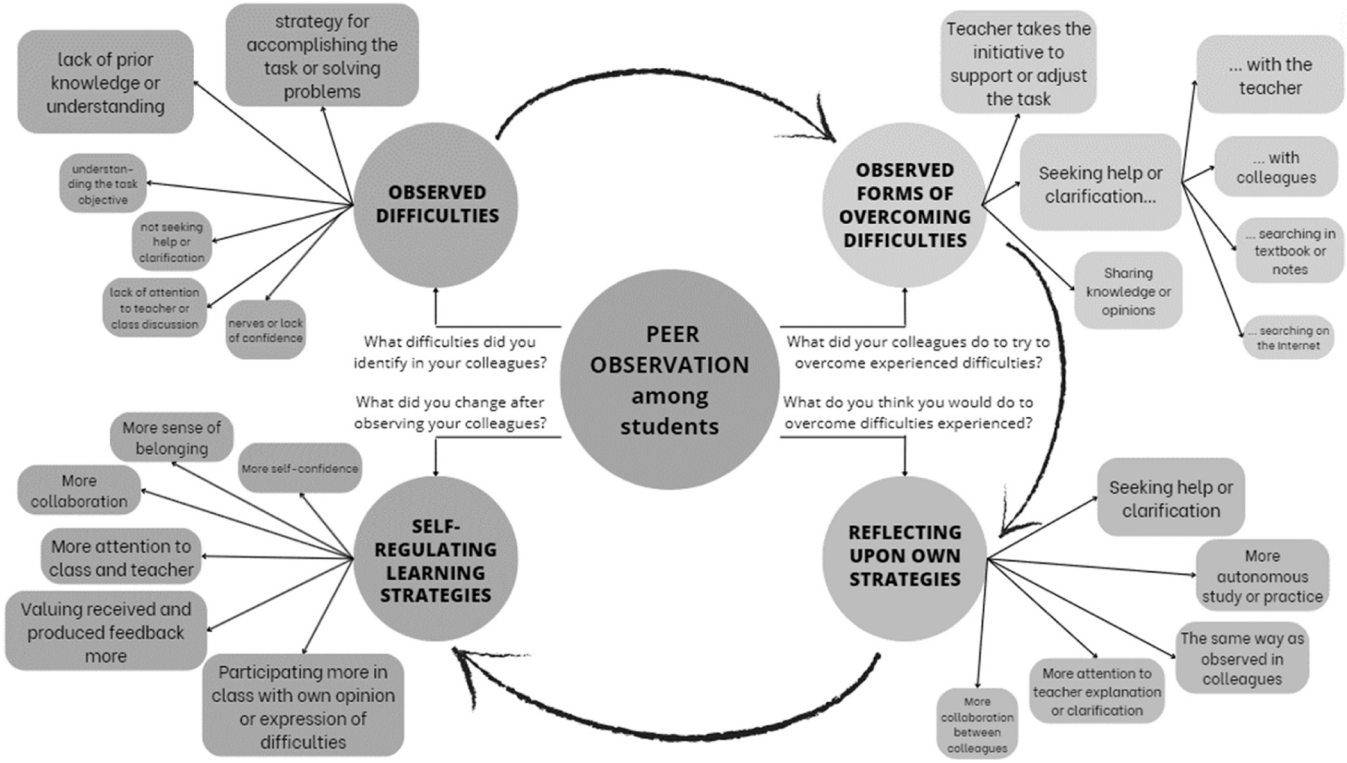


Fig. 2. Thematic map of students' reflections about their own learning upon peer observation of task or activity performance.

subthemes and examples of coded excerpts is presented in Table 3.

The theme of observed difficulties emerged from answers in the observation guide to the question "*What difficulties do you identify in your peers?*". Students reported more often on issues related to the assigned tasks followed by issues related to their peers' behaviour. In difficulties related to the tasks, the students' answers uncovered difficulties experienced with the strategy to solve the task or exercise, with some amount of detail related to the specific subject content it developed. However, students were also able to relate the observed difficulties to a lack of knowledge or understanding of basic concepts or processes that were previously introduced. Often this lack of understanding was connected with the recognition of behaviours in their peers that posed barriers to engagement with tasks, such as lack of attention, lack of self-confidence or avoidance of seeking clarification or help.

A second subtheme had to do with the strategies to overcome difficulties that were observed and identified in the peers, which are summarized in Table 4.

This theme emerged from analysing students' answers in the observation guide to the question "*How did they try to overcome difficulties?*" and reported different ways of seeking help or clarification mainly with the teacher, but also with colleagues, notes, and the Internet. Often students listed different kinds of help sought on the same answer. In this theme, students' answers also allowed us to some extent to recognize that the students differentiated between clarifications from the teacher sought by their peers and clarifications given by the teacher on his/her own initiative when being attentive to the class climate, particularly concerning the students' engagement with the task.

A third theme related to the internal feedback and reflection mechanisms which student observers activate to think about how they would perform to overcome observed difficulties and the identified subthemes and examples of coded excerpts is presented in Table 5.

The observers' reflections about what they would do to overcome experienced difficulties resulted from analysing students' answers to the observation guide question "*How do you think you would try to overcome the difficulties?*". In this regard, while a few students simply said they would do the same as their peers did (eight references), most answers reported some kind of help or clarification seeking. Interestingly, in responding to this question, some students felt the need to sequence

Table 3
Subthemes to determine "What difficulties in engaging with learning tasks do students identify when observing their peers?".

Theme	Subthemes	Examples of coded excerpts
Observed difficulties	strategy for accomplishing the task or solving problems	*There were difficulties during the resolution of the tasks, most of which were related to the methodology for solving them. (PA)*
		When carrying out the tasks there was some difficulty in solving them, because as they were done in groups some of my colleagues had different opinions and were unsure which way they would use to solve the question. (OI)
	lack of prior knowledge or understanding	*Yes, there were difficulties in solving the tasks, with a notable lack of knowledge of important, previously studied concepts. (PP)*
		There were doubts arising from lack of attention or lack of previous consolidation of the subject matter (OE)
	not seeking help or clarification	*Yes, there were difficulties, mostly in textual cohesion and in deictics, but my colleagues were not attentive and did not clarify many doubts. (PM)*
	understanding the objective of the task, problem or exercise	*Yes, there were difficulties in understanding what was intended in some exercises. (OD)*
	lack of attention to the teacher or class discussions	*Yes, because most people weren't paying attention. (OG)*
	nerves or lack of confidence	*I also noticed that the members of some groups began to have more difficulties because they took longer to carry out the exercise than was necessary (…) and as time passed, they became nervous, and it was not advantageous. (OI)*
	not specified	*Yes, there were difficulties. (OH)*
	no difficulties observed	*There were no difficulties. (PK)*

Notes: first letter corresponds to type of observation [O = online and P = in-presence] and second letter corresponds to student observer code [A to P to distinguish each of the 16 participant students].

Table 4
Subthemes to determine "What strategies to overcome difficulties do students recognize while observing their peers?".

Theme	Subthemes	Examples of coded excerpts
Observed forms of overcoming difficulties	The teacher takes the initiative to support or adjust the task	*The difficulties were overcome with the help of the teacher who, when first carrying out some of the exercises, explained them so that the students understood how to solve the activities, then throughout the class, whenever an impasse arose, the teacher reminded the students of how it was carried out previously in an identical exercise or gave a little help by proposing a small part of the resolution of the proposal. (OI)*
		The teacher made an explanation and changed the teams for them to be more balanced. (PD)
	Seeking help or clarification… with the teacher	*The students asked the teacher, and she recapped some previously learned definitions. (OJ)*
		When their doubts persisted, they resorted to the teacher (PB)
	Seeking help or clarification… with colleagues	*As they were groups, my colleagues helped each other and what one member did not see or know, the other colleague could see or know and thus difficulties were overcome through dialogue and consensus between everyone. (OI)*
		Difficulties were overcome with the help of the teacher and colleagues (PL)
	Sharing knowledge or opinions	*If there are difficulties and uncertainties, they are invited to give their opinion, which will be corrected and/or improved by the teacher. By sharing different opinions, it becomes easier to understand each other. (OE)*
		Difficulties were overcome through sharing knowledge between group members and between groups (PA)
	Seeking help or clarification… searching in textbooks or notes	*Difficulties were overcome by resorting to the textbook, and other colleagues, but rarely resorting to the teacher. (PO)*
		The students also used exercises and notes from the daily notebook. (OJ)
	Seeking help or clarification… searching on the Internet	*Difficulties were overcome by asking the teacher questions or using the Internet. (PL)*

Notes: first letter corresponds to type of observation [O = online and P = in-presence] and second letter corresponds to student observer code [A to P to distinguish each of the 16 participant students].

Table 5
Subthemes to determine "What self-feedback do students produce about what they must do to overcome identified difficulties?".

Themes	Subthemes	Examples of coded excerpts
Observers' self-feedback on how they would try to overcome identified difficulties	Seeking help or clarification	*If it were me, faced with the same difficulties, I would turn to the members of my group, then to the members of another group and, as a last resort, to the teacher. (PA)*
		I would ask the teacher about my doubts and difficulties. (OF)
	More autonomous study or practice	*If I had these doubts, I would also talk to my classmates and teacher. After the class, I would repeat the exercise and other similar ones and if the doubt persisted, I would ask the teacher in the next synchronous class. (OJ)*
		I would do exercises according to the teachers' explanation (PC)
	More attention to teacher's explanation or clarification	*I would pay close attention to the teacher's explanation and try to balance the teams. (PD)*
		I would be with more attention to the instructions given by the teacher and ask for help if I had doubts (OD)
	Asking the teacher to adjust the class schedule (referring to emergency remote teaching)	*The teacher should change the time of the class to an hour later. (OG)*
	Collaboration between colleagues	*If it were me, I think I would overcome difficulties in the same way as my colleagues, because they respected and helped each other and that is the best way to work in a group. (OI)*
	In the same way as the observed colleagues	*I would do the same as my colleagues did. (OF)*
		I would probably use the same methods my colleagues did. (PK)

Notes: first letter corresponds to type of observation [O = online and P = in-presence] and second letter corresponds to student observer code [A to P to distinguish each of the 16 participant students].

Table 6
Subthemes to determine "What changes do students recognize in their own engagement with learning tasks from observing and reflecting upon their peers' strategies?".

Themes	Subthemes	Examples of coded excerpts
Identified changes in their own performance	Participating more in class with their own opinion or expression of difficulties	*I participate and help my colleagues more because the students' intervention motivated me. (Q6)*
	Valuing received and produced feedback more	*With my participation, I started to value the feedback from my classmates about the classes more. (Q9)*
		I felt that my opinion is really important. (Q5)
	More attention to class and the teacher	*I became more attentive and obedient to the teacher. Because the teacher works hard to transmit his wisdom to us and students often do not give him the due value. (Q1)*
		By taking part in the project, I believe that my attitude in the classroom has changed for the better because I have more attention in the class. (Q4)
	More collaboration	*I avoid isolation and start collaborating with my teachers and classmates.* (Because) *I feel that my opinion matters. (Q5)*
		I realised that the opinion of everyone involved in a given situation is important and that we should all try to work together to find solutions to our problems. (Q12)
	More sense of belonging	*I avoid having passive activity in classes but rather be more of an active voice. (Because) I discovered that all opinions are important and can make a difference. (Q9)*
	More self-confidence	*The project made me safer, as I wasn't afraid to give my opinion and actively participate. (Q10)*
	No changes	*I didn't change anything in particular. (Q14)*

Notes: first letter corresponds to type of observation [O = online and P = in-presence] and second letter corresponds to student observer code [A to P to distinguish each of the 16 participant students].

their strategies demonstrating a thorough reflection about how they engage with learning tasks, as illustrated here: "*If I were the one having these doubts, I would ask the teacher. After class, I would repeat the exercises again and if necessary, again after some more time. If I had a question outside of class, I would use independent research on the Internet, textbooks, etc. I would speak with the teacher in the next class, if necessary*". In relation to this, at this point, students also acknowledge the need for more autonomous practice on their own and seek other types of support beyond the teacher's clarification. Fewer students also acknowledge the importance of more attention in class and more collaboration with peers.

A final theme concerning the changes identified by student observers in their own performance and the identified subthemes and examples of coded excerpts is presented in Table 6.

The last theme arose from the students' answers in the final questionnaire to the questions "*What has changed with your participation in this programme?*" and "*What have you started to do? Or what have you stopped doing?*" and it listed students' self-reported changes in their own performance. While the previous themes emerged from analysing students' answers in the observation guides, this is the only theme that we organized solely from the students' answers to the questionnaire. In this theme, most coded answers had to do with valuing feedback in the class or valuing the teacher's performance. Moreover, feedback was valued just as much from the recipient's point of view as from the producer's point of view. Quite important also is that students were able to acknowledge the importance of their participation in class with opinions, difficulties or requests for the teacher to organize a pedagogical response which was better able to promote student learning and adjust class activities. However, peer feedback was also valued as well as teacher feedback when students recognized the importance of being attentive to the teacher's explanations in class.

5. Discussion, implications and limitations

A real case of promoting SRL through peer observation among secondary school students was analysed. With the framework used, the connections that could be established between peer observation and self-regulation learning based on Zimmerman's model (2000) are discussed. Starting from the main question *How do students regulate their*

own learning by observing their peers in the performance of a task? the collected data allows for an understanding of the following sequence: the more students *observed difficulties* in their peers' performance and identified ways of *overcoming these difficulties*, the more they were able to *reflect on their own strategies* and develop awareness of *SRL strategies*. This understanding of the path followed by students during peer observation enabled us to design the thematic map illustrated in Fig. 2.

This thematic map is an illustration of how the findings demonstrate a novel way to establish a relationship between peer observation with a clear pedagogical intent and the improvement of student SRL. In fact, the potential of observing peers for self-regulation skills development has been extensively highlighted for processes of modelling and emulation of behaviours (White & DiBenedetto, 2015; Zimmerman & Kitsantas, 2002). However, our findings support a strong potential of peer observation for promoting self-regulation due to the mirror effect that observation causes in students when observing their peers, enhancing self-reflection and self-feedback about how one's performance can be improved. Also, the above classification of the themes and subthemes contributes to strengthening the study of SRL emphasizing the importance of students surpassing difficulties they face in the learning process from a constructivist perspective, as well as a collective understanding of their social impact. Furthermore, to be aware of learning difficulties is a first crucial step to overcome individual learning challenges.

Additionally, the findings highlight the crucial mediating role of self-reflection resulting from the transition from observing others to self-reflection, emphasizing the benefits of such a connection. The significance of otherness in this process has been previously argued in the work of Hadwin, Jarvëla and Miller (2018), as well as in other educational contexts and roles (Mouraz, & Ferreira, 2021).

Despite differences in players and situations, similar results were found when teachers' peer observation was the focus. A study concentrating on the effects of teaching peer observation revealed that teachers had the opportunity to reflect on the practices they observed, primarily in the role of observers rather than being observed (Mouraz, & Ferreira, 2021). The evident growth in students' awareness of the learning process, both from the perspective of others and their own, is reflected in the SRL strategies they reported. Consequently, the interpretation leads to the conclusion that self-reflection is closely intertwined with self-feedback.

Based on the presented results, a model was developed to illustrate how peer observation could promote SRL through self-feedback. Building upon Zimmerman's model (Zimmerman, 2000; Zimmerman & Kitsantas, 2002, 2005; Zimmerman & Moylan, 2009), this model emphasizes the importance of an open-ended process shaped in a spiral that arises from the interactive cycles it encompasses (see Fig. 3).

This proposal balances the iterative cycles and the progressive effects on SRL, as expressed in Fig. 3. This model can be used to inform the design and development of teaching and learning activities that integrate purposeful, pedagogical peer observation to scaffold student SRL. Moving beyond the traditional self-evaluation activities, teachers can integrate peer observation and feedback cycles, especially in group activities, by inviting one student to be an observer of the group and having a sequence of simple and structured subtasks: (1) *observation* of the peers' difficulties and how they are resolved, (2) *reflection* upon the observation, (3) organizing and providing *feedback* on what was observed, (4) organizing *self-feedback* on how one would resolve the observed difficulties in a similar situation, (5) plan and execute improved *performance* on subsequent learning activities. Moreover, the spiral scheme represents the gradual fading of the need for teachers' supervision with the progression of different cycles of peer observation and feedback, when scaffolding student SRL strategies, as suggested by Perry and Rahim (2011).

This model and the design-based research process to reach it have a set of implications for the intertwining of collaboration, feedback, and teacher agency that we must highlight.

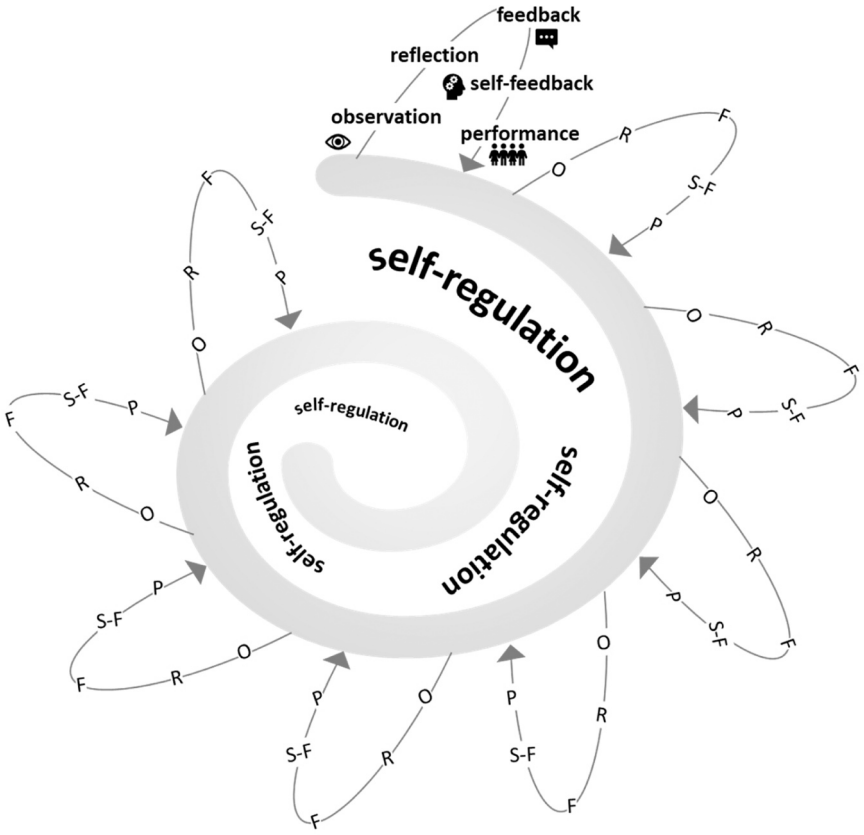


Fig. 3. Model of self-regulation promoted through cycles of peer observation and feedback.

First, the findings and their connections with the model emphasize the crucial role of teachers in peer observation and feedback as a strategy to scaffold SRL, not only through its substantiated integration in learning activities but also by serving as models of the observers' role. Findings pointed out to how written feedback produced by student observers mimics teachers' evaluation and feedback criteria especially concerning aspects such as attention, consolidation of prior knowledge, participation, and help-seeking, which also constitute important behavioural features of a self-regulated learner (Zimmerman, 2000). In line with the findings of other studies (Dignath & Veenman, 2021; White & DiBenedetto, 2015) the modelling role of teachers is important to configure the observer's role of participating students.

Moreover, while in this programme we delved into how feedback to the teacher from observation and reflection triggered student self-feedback and related to student perceptions of an improvement in their class participation, the same model is sufficiently flexible to integrate a component of peer feedback in the *feedback* stage of the cycle. The integration of a moment for the student observer to discuss the reflection with their observed classmates not only strengthens collaboration within group activities but also improves the connection of collaboration with SRL, activating socially shared regulation (Hadwin et al., 2018).

This relates to one of the study's limitations, which was the insufficient exploration of the opportunity to expand the potential of peer feedback in the peer observation programme. This happened due to the primary focus in the collaborative design of the model itself and experimenting how students could adopt the role of observers and use it to reflect upon their own learning strategies. However, we are certain that the model can be applied to a learning activity design in which the feedback stage includes peer feedback; we are already experimenting with this in a new ongoing project, and we suggest experimented further in other studies and novel contexts. Furthermore, the possibility of expanding this model to different disciplinary settings to test its fit into diverse pedagogical and didactical informed work group activities is also an aspect to be explored in the future. In our study, we were able to implement the programme in mathematics, computer systems programming, natural sciences, Portuguese, and physical education. Nevertheless, the limited group of students and teachers involved, as well as the forced move from in-person classes to online classes due to the pandemic induced school closures prevents us from making any possible relations between the model and different disciplinary settings, as well as making comparisons between teaching settings and modalities. Still, we believe that the combined use of the students' comments on observations and their answers to the open-ended questionnaires helps to ensure the reliability of our analysis concerning deepening the experience of students as observers in a learning activity.

Finally, the fact that the student selection was entirely up to the participating teachers also constituted a limitation to a more thorough analysis of how individual factors such as self-confidence, self-efficacy or educational attainment might result in different student comments and different levels of progression in SRL strategies. Recognizing these limitations, we recommend this model be consistently experimented upon in all group activities of one class group to test its fit into different disciplinary settings and teaching modalities, as well as its potential for strengthening the connections between self- and peer feedback, SRL, and socially shared regulation of learning (Hadwin et al., 2018). Moreover, having the model tested in one class group through a medium- or long-term intervention with quantitative and longitudinal monitoring can help explore its effectiveness in scaffolding SRL skills in students with different levels of self-confidence, self-efficacy, and educational attainment and in relation to wider sets of subject-specific as well as and transversal competencies.

6. Concluding remarks

In Portugal, an ongoing national reform to provide schools with the necessary conditions to manage the curriculum with autonomy and flexibility, was framed by the "Students' Profile by the End of Compulsory Schooling" (ME/DGE, 2017) which calls for the development of students' SRL as a part of their personal development and autonomy, one of ten core competence areas to be developed throughout 12 years of schooling. Within such areas of competencies, SRL is viewed in association with self-confidence, learning motivation, self-initiative and decision-making as essential for students to establish relationships between knowledge, emotions and behaviours; to identify areas of interest and the need to acquire new skills; to consolidate and deepen the skills they already have; and to establish objectives, draw up plans and implement projects with a sense of responsibility and autonomy. Students are expected to increase their ability to recognize their own strengths and weaknesses and to express their needs and difficulties, seeking more effective support for them to reach their objectives. As shown in this study, peer observation towards feedback and self-feedback have great potential to pursue these expectations and its integration in class activities can support scaffolding student SRL. As such, this study contributes to existing knowledge about ongoing reforms such as this with insights on how student peer observation and feedback, including self-feedback, can be integrated in more active learning strategies with increased collaboration and strengthened student self-reflection. Additionally, it adds to Zimmerman's model (Zimmerman, 2000; Zimmerman & Moylan, 2009) of SRL by explaining a novel way of how observation can be strengthened to improve reflection and a new cycle of forethought and performance.

The findings of this pilot phase of the programme suggest promising avenues for further exploration, with peer observation emerging as a catalyst for fostering SRL. Through the process of peer observation, students engage in a reflective journey, wherein they not only receive feedback from their peers but also internalize and apply it to enhance their learning journey. Moreover, the cyclical nature of peer observation, coupled with feedback mechanisms, creates a mirror effect, when students recognize in themselves difficulties, possibilities and potentials they observe in their peers, thereby promoting self-reflection and self-regulation. This collaborative and student-centred approach to learning, driven by peer observation and feedback strategies, holds potential to contribute to the holistic student's development, corresponding to the aims of current educational policies.

This study had several limitations that should be considered when interpreting its results and pursue further advancements. Firstly, only two observation cycles were conducted. Additionally, the sample size of the study was relatively small and restricted to two schools located in a similar geographic region. This limitation in both sample size and diversity may reduce the generalizability of the results. The lack of geographic and institutional variability might not accurately reflect how the program would perform in a broader and more diverse educational context. Another relevant factor to consider is the impact of the pandemic, which necessitated a shift to online classes. This exceptional context may have influenced the program's results, either positively or negatively. Further research with larger samples and in diverse contexts, as well as an evaluation of the impact of extraordinary conditions like the pandemic on educational intervention programs, is needed. As such, in future studies, we recommend a greater number of observation cycles to allow for more robust interpretations of reported effects. Including additional cycles will allow for a more comprehensive and reliable evaluation of the impacts of peer observation and feedback, as well as the of the quality of the feedback produced. Moreover, extending this possibility to whole-class groups, more school levels and more disciplines will allow for its testing and validation with experimental studies focusing on different skills related with SRL (e.g., help-seeking, teamwork, collaboration, critical thinking) and deepening its potential in various learning contexts allowing for adjustments and improvements to wider pedagogical strategies.

Considering the explored potential of this peer observation programme, even if highly contextualized in a small-scale design research

pilot intervention, efforts are underway to adapt and refine the model for broader application with students in various regions of Portugal as part of a more comprehensive project, where some of these limitations are being surpassed. This broader initiative aims to delve deeper into both the strengths and limitations of the self-regulation of learning and feedback model, thereby paving the way for a more nuanced understanding of its efficacy.

Funding

This work was partially co-funded by national funds, through the Portuguese Foundation for Science and Technology (FCT) under the multi-annual funding awarded to CIIE [grants UIDB/00167/2020 and UIDP/00167/2020]. Ana Cristina Torres also acknowledges FCT funding for her contract established under the transitional rule of Decree-Law 57/2016, amended by Law 57/2017 (SFRH/BPD/108950/2015).

CRediT authorship contribution statement

Ana Mouraz: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Daniela Pinto:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Data curation. **Marina Duarte:** Writing – original draft, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Ana Cristina Torres:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Acknowledgments

The co-authors wish to acknowledge the enthusiastic collaboration of the voluntary teachers and students who participated in this pilot programme, even when caught up by the rapid changes induced by the COVID-19 pandemic. The authors also highlight the invaluable contributions of their colleague, Marina Duarte, who actively engaged in all stages of the programme's development, but regrettably passed away in September 2023. Beyond the dissemination of research findings, this article serves as a poignant tribute, acknowledging and honouring her integral role in the design and investigative processes.

APPENDIX A. Observation guide – first version for in-person class observation

SECTION	QUESTION	TYPE OF ANSWER
1– CONTEXT: OBSERVING STUDENT AND OBSERVED CLASS	1.1. School	School A or School B
	1.2. Observing student code	Provided by the teacher to ensure anonymity
	1.3. Gender of observing student	Male or female
	1.4. Age of observing student	Open answer
	1.5. School grade	Grades 9, 11 or 12
	1.6. Attended course (if in upper secondary)	Open answer
	1.7. Have you been engaged in class observations before?	Yes or no
	1.8. Cycle of observation	1st – February or 2nd – May
	1.9. Subject of the observed class	Open answer
	1.10. Observation date	Open answer
	1.11. How would you describe the tasks proposed in the lesson you observed (e.g. were they easy or difficult, were they motivating, were they useful for learning the content, did they promote class interaction)?	Open answer
2 – OBSERVING PEERS IN THE CLASS	During the observation, how many of your colleagues… 2.1. … understood the task and started immediately to perform the tasks?	4-point scale: some, half, most, all
	During the observation, how many of your colleagues… 2.2. … did not understand the task and asked the teacher for help?	4-point scale: some, half, most, all
	During the observation, how many of your colleagues… 2.3. … did not understand the task and asked colleagues for help?	4-point scale: some, half, most, all
	During the observation, how many of your colleagues… 2.4. … started to complete the task by using the textbook, notebook or other notes to get support in performing the assignment?	4-point scale: some, half, most, all
	During the observation, how many of your colleagues… 2.5. … other option, and its description.	Open answer
3 – REFLECTION ON OBSERVATION	3.1. Were there any difficulties in solving the tasks? If so, what were they?	Open answer
	3.2. If there were difficulties, how were they overcome?	Open answer
	3.3. If it happened to you, how would you overcome the difficulties you've observed in your colleagues?	Open answer

APPENDIX B. Observation guide – second version for remote and digital class observation

SECTION	QUESTION	TYPE OF ANSWER
1 – CONTEXT: OBSERVING STUDENT AND OBSERVED CLASS	1.1. School	School A or School B
	1.2. Observing student code	Provided by the teacher to ensure anonymity
	1.3. Gender of observing student	Male or female
	1.4. Age of observing student	Open answer
	1.5. School grade	Grades 9, 11 or 12
	1.6. Have you been engaged in class observations before?	Yes or No
	1.7. Cycle of observation	1st – February or 2nd – May
	1.8. Subject of the observed class	Open answer
	1.9. Observation date	Open answer
	1.10. Type of observed activity (e.g. online class in Zoom, chat discussion, task in Moodle, etc.)	Open answer

(*continued on next page*)

(*continued*)

SECTION	QUESTION	TYPE OF ANSWER
	1.11. How would you describe the tasks proposed in the lesson you observed (e.g. were they easy or difficult, were they motivating, were they useful for learning the content, did they promote class interaction)?	Open answer
2 – OBSERVING PEERS IN THE CLASS	During the observation, how many of your colleagues… 2.1. … interacted with the teacher during the class/activity?	5-point scale: all students, more than half, about half, less than half, or none
	During the observation, how many of your colleagues… 2.2. … interacted with class colleagues during the class/activity?	5-point scale: all students, more than half, about half, less than half, or none
	During the observation, how many of your colleagues… 2.3. … showed motivation or interest in completing the proposed task?	5-point scale: all students, more than half, about half, less than half, or none
	During the observation, how many of your colleagues… 2.4. … showed difficulties in understanding the task or deciding how to complete it?	5-point scale: all students, more than half, about half, less than half, or none
3 – REFLECTION ON OBSERVATION	3.1. Were there any difficulties in solving the tasks? If so, what were they?	Open answer
	3.2. If there were difficulties, how were they overcome?	Open answer
	3.3. If it happened to you, how would you overcome the difficulties you've observed in your colleagues?	Open answer

(Note: Bold formatting marks the changes to the first version of the observation guide)

APPENDIX C. Online questionnaire to collect the student's perspectives on the programme's effects on their self-regulation

SECTION	QUESTION	TYPE OF ANSWER
1 – THE OBSERVING STUDENT AND OBSERVED CLASS	1. School	School A or School B
	2. Gender of observing student	Male or female
	3. Age of observing student	Open answer
	4. 1.5. School grade	Grades 9, 11 or 12
	5. Type of observation	Options: 1) In-person observation (in classroom); 2) Online observation (in digital environment); or 3) Both observations (in classroom and in digital environment)
2 – FIRST IMPRESSIONS OF PARTICIPATING IN THE PROGRAMME	2.1. State 3 key words about your participation in the programme	Open answer
	2.2. The best moment of my participation in the programme was …	Open answer
	2.3. Why was it the best moment in your participation in the programme?	Open answer
	2.4. A good surprise in my participation was…	Open answer
	2.5. Why was it a good surprise in your participation in the programme?	Open answer
	2.6. The most difficult part of my participation was …	Open answer
	2.7. Why was it a difficult part of your participation in the programme?	Open answer
3 – REFLECTION ON EFFECTS ON SELF-REGULATION	3.1. Because of doing peer observation, during classes, I started trying not to…	Open answer
	3.2. Why? What changed with your participation in the programme?	Open answer
	3.3. Because of doing peer observation, during classes, I started to work harder for…	Open answer
	3.4. Why? What changed with your participation in the programme?	Open answer
	3.5. Was it important for you to participate? Why?	Open answer

References

Bandura, A. (2004). Observational Learning. In J. H. Byrne (Ed.), *Learning and Memory* (2nd ed., pp. 482–484). Macmillan Reference USA. https://link.gale.com/apps/doc/CX3407100173/GVRL?u=cuny_hunter&sid=bookmark-GVRL&xid=369c6e06.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101. https://doi.org/10.1191/1478088706qp063oa

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.)). Boston, MA: Pearson.

Dignath, C., & Veenman, M. V. J. (2021). The Role of Direct Strategy Instruction and Indirect Activation of Self-Regulated Learning—Evidence from Classroom Observation Studies. *Educational Psychology Review, 33*, 489–533. https://doi.org/10.1007/s10648-020-09534-0

EC – European Commission (2019). *Key competences for lifelong learning.* Publications Office. https://doi.org/doi/10.2766/569540.

Eriksson, E., Boistrup, L., & Thornberg, R. (2018). A qualitative study of primary teachers' classroom feedback rationales. *Educational Research, 60*(2), 189–205. https://doi.org/10.1080/00131881.2018.1451759

Fernandez-Rio, J., Cecchini, J. A., Méndez-Gimenez, A., Mendez-Alonso, D., & Prieto, J.Á. (2017). Self-regulation, cooperative learning, and academic self-efficacy: Interactions to prevent school failure. *Frontiers in Psychology, 8*(22). https://doi.org/10.3389/fpsyg.2017.00022

Hadwin, A., Järvelä, S., & Miller, M. (2018). Self-regulation, co-regulation and shared regulation in collaborative learning environments. In D. H. Schunk, & J. A. Greene (Eds.), *Handbook of Self-Regulation of Learning and Performance (2nd edition ed.)*. Routledge. https://www.routledge.com/Handbook-of-Self-Regulation-of-Learning-and-Performance/Schunk-Greene/p/book/9781138903197.

McKenney, S., Nieveen, N., & van den Akker, J. (2006). Design research from a curriculum perspective. Chap. 5. In J. van den Akker, K. Gravemeijer, S. McKenney, & N. Nieveen (Eds.), *Educational Design Research* (pp. 67–90). Routledge. Chap. 5.

ME/DGE - Ministério da Educação / Direcção-Geral da Educação. (2017). *Perfil dos Alunos à Saída da Escolaridade Obrigatória [Students' Profile by the End of Compulsory Schooling]*. Lisboa, Portugal: Ministério da Educação.

Mieder, K., & Bugos, J. A. (2017). Enhancing self-regulated practice behavior in high school instrumentalists. *International Journal of Music Education, 35*(4), 578–587. https://doi.org/10.1177/0255761417689921

Molloy, E. K., & Boud, D. (2014). Feedback models for learning, teaching and performance. *In Handbook of Research on Educational Communications and Technology: Fourth Edition* (pp. 413–424). Springer New York. https://doi.org/10.1007/978-1-4614-3185-5_33

Moura, A., MacPhail, A., Graça, A., & Batista, P. (2024). Encouraging students to co-construct and co- and self-regulate their learning within a cooperative learning environment in physical education. *Journal of Teaching in Physical Education, 43*(1), 11–20. Retrieved Aug 10, 2024, from https://doi.org/10.1123/jtpe.2022-0104.

Mouraz, A., & Ferreira, I. (2021). Contributions of multidisciplinary peer observation to lecturers' reflective practices. *Journal of Interdisciplinary Studies in Education, 10*(1), 41–58.

Mouraz, A., Pinto, D., & Torres, A. C. (2022). Effects of a model for multidisciplinary peer observation of teaching in teacher professional development and in nurturing a reflective school. *Reflective Practice*. https://doi.org/10.1080/14623943.2022.2130225

Nguyen, P. V. (2020). TT-SET augmented with POT: A potential framework for academics' pedagogical reasoning. *Reflective Practice, 21*(1), 14–27. https://doi.org/10.1080/14623943.2019.1708303

Nicol, D. (2021). The power of internal feedback: Exploiting natural comparison processes. *Assessment Evaluation in Higher Education, 46*(5), 756–778. https://doi.org/10.1080/02602938.2020.1823314

OECD (2018a). *The Future We Want. The future of education and skills Education 2030 (position paper)*. https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf.

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 8*, 1–28. https://doi.org/10.3389/fpsyg.2017.00422

Panadero, E., Brown, G. T. L., & Strijbos, J. W. (2016). The future of student self-assessment: a review of known unknowns and potential directions. *Educational Psychologist Review, 28*, 803–830. https://doi.org/10.1007/s10648-015-9350-2

Perry, N. E., & Rahim, A. (2011). Studying self-regulated learning in classrooms. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 122–136). Routledge/Taylor & Francis Group.

Shortland, S. (2010). Feedback within peer observation: Continuing professional development and unexpected consequences. *Innovations in Education and Teaching International, 47*(3), 295–304. https://doi.org/10.1080/14703297.2010.498181

St-Onge, C., Martineau, B., Harvey, A., Bergeron, L., Mamede, S., & Rikers, R. (2013). From see one do one, to see a good one do a better one: Learning physical examination skills through peer observation. *Teaching and Learning in Medicine, 25*(3), 195–200. https://doi.org/10.1080/10401334.2013.797342

Tamura, T., & Uesugi, Y. (2020). Involving students in lesson study: a new perspective. *International Journal for Lesson and Learning Studies, 9*(2), 139–151. https://doi.org/10.1108/IJLLS-04-2018-0026

Visone, J. D. (2019). What teachers never have time to do: Peer observation as professional learning. *Professional Development in Education, 48*(2), 203–217. https://doi.org/10.1080/19415257.2019.1694054

White, M. C., & DiBenedetto, M. K. (2015). *Self-regulation and the common core: application to ELA standards*. Routledge.

Xu, W., & Zammit, K. (2020). Applying thematic analysis to education: A hybrid approach to interpreting data in practitioner research. *International Journal of Qualitative Methods, 19*, 1–9. https://doi.org/10.1177/1609406920918810

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-Regulation* (pp. 13–39). Academic Press. https://doi.org/10.1016/B978-012109890-2/50031-7.

Zimmerman, B. J., & Kitsantas, A. (2005). The hidden dimension of personal competence: self-regulated learning and practice. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of Competence and Motivation* (pp. 509–526). Guilford Publications.

Zimmerman, B. J., & Kitsantas, A. (2002). Acquiring writing revision and self-regulatory skill through observation and emulation. *Journal of Educational Psychology, 94*, 660–668. https://doi.org/10.1037/0022-0663.94.4.660

Zimmerman, B. J., & Moylan, A. R. (2009). Self-regulation: where metacognition and motivation intersect. In In. D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of Metacognition in Education* (pp. 299–315). Routledge.