Check for updates

# Teaching self-regulation through role modeling in K-12

Tufan Adıgüzel[1]*, Gürsu Aşık[2], Mehmet Akın Bulut[3], Mehmet Haldun Kaya[4] and Serkan Özel[5]

[1]Sectoral Education Program, Özyeğin University, Istanbul, Türkiye, [2]Faculty of Educational Sciences, Bahçeşehir University, Istanbul, Türkiye, [3]Faculty of Educational Sciences, Ibn Haldun University, Istanbul, Türkiye, [4]School of Foreign Languages, Izmir University of Economics, Izmir, Türkiye, [5]Faculty of Education, Boğaziçi University, Istanbul, Türkiye

For K-12 teachers to develop effective teaching skills, integration of role modeling strategies into teaching and learning process as a dimension of selfregulated learning is of the foremost value. Role modeling strategy training through a hybrid professional development model bears the potential to serve as a facilitating component in promoting K-12 teachers' instructional competence. Conducted within the self-regulated learning framework, this study suggested findings of a teacher professional development training aimed at role modeling strategy implementation at K-12 level. Pursuing a mixed-method model, the current research was performed with 16 teachers who were trained and supervised to integrate role-modeling strategies into their teaching context. In this study, the data sources were role-modeling-integrated lesson plans, trainers' feedback on these lesson plans, and online student products. The data collection methods included lesson plan evaluation through a role-modeling rubric in a quantitative fashion, whereas content analysis of trainer feedback on lesson plans, latterly revised lesson plans and online student products composed the qualitative aspect. Results revealed that this professional development training achieved significantly positive changes in teachers' role modeling strategy implementation skills, particularly in terms of teachers' role as agents in students' self-regulated learning skills, promotion of student-centered learning and overall improvement in students' self-regulated learning skills. Further, the integration of education technology tools into lessons was observed to have a positive impact on enhancing students' self-regulated learning skills. This study could offer major contributions to designing teacher professional development training for researchers, practitioners, and teacher trainers, particularly in role modeling dimension of self-regulated learning.

KEYWORDS

self-regulated learning, role modeling, teacher training, professional development, education technology, K-12

## 1. Introduction

Some learners are able to develop their self-regulatory competence and gain self-regulated learning (SRL) skills on their own; however, such a route based on self-discovery is often a lengthy process leading to fatigue and frustration (Zimmerman, 2000). In addition, few students can pick up SRL automatically (Boekaerts, 1997), and therefore, teaching students how to acquire such skills has become a popular practice of instruction in schools (Zimmerman and Schunk, 2001; Wolters and Brady, 2021). Although most teachers want their students to become self-regulated learners, they describe this process as a great challenge (Panadero and Alonso-Tapia, 2014; Thomas et al., 2022). This difficulty stems from teachers' inadequate knowledge of SRL, limited self-efficacy in

implementing SRL for students, lack of implementations of SRL strategies, and misconceptions about SRL, such as the notion that it cannot be taught (Dignath and Büttner, 2018; Karlen et al., 2020). However, it is known that teaching SRL is achievable at almost any grade level, from elementary school to university, if students are provided with appropriate SRL skills instruction in their learning environment (Schunk and Zimmerman, 1996; Cengiz-Istanbullu and Sakiz, 2022). However, very few teachers are able to prepare their students to this end. They rarely focus on students' cognitive or motivational challenges, or present students with an opportunity to set their own goals, monitor their own progress, reflect on their performance, or work on explicit learning strategies (Zimmerman, 2000; Esparragoza, 2021).

Although SRL teaching has an undeniable value for instructors, there is a dearth of studies or resources. Thus, the complex and multifaceted nature of SRL teaching still requires research, presenting practical implications of the related theoretical knowledge. This study examines the implications of a professional development training program focused on role modeling as an SRL strategy to help students gain SRL skills. This is expected to lead to outcomes, which can be observed in lesson plans prepared by the participant K-12 teachers, feedback given by experts on those lesson plans, and online products created by students.

The extensive literature on SRL is generally fragmented and diverse. Hence, after filtering many studies and research, we arrived at a clear definition of SRL with a particular emphasis on its distinct components, suggested models, its impact on learners, and how to measure it. More importantly, the studies on teaching SRL, specially through role modeling, are also reviewed this current study.

## 1.1. Definition of self-regulated learning and suggested models

Self-regulated learning is a fundamental conceptual framework to comprehend the motivational, cognitive, affective, and behavioral dimensions of learning (Panadero, 2017). Focused on students' proactive use of certain processes and actions to achieve success at school, Zimmerman (1986) defines it as the degree to which learners are motivationally, metacognitively, and behaviorally active during learning. For Pintrich (2000), it is also an active and productive process through which learners identify their learning goals and monitor, adjust, and control their motivation, cognition, and behavior in their learning context. As the definitions indicate, SRL cannot be reduced to mere metacognition, since metacognition is one among many components of SRL (Winne and Hadwin, 1998). Additionally, SRL is not a single cognitive skill or an academic performance ability (Zimmerman, 2000). Rather, it consists of a variety of diverse skills and strategies that learners employ depending on certain factors such as their (meta)cognition, motivation, emotion, and instructional environment during their learning (Kaplan, 2008). Apart from schools' academic environment, SRL could also be supported at home by parents (Dermitzaki and Kallia, 2021). Thus, SRL can be viewed as a complex process influenced by multi-factors, but mainly directed by learners for shifting their affective, motivational, and mental abilities towards the achievement of academic success (Zimmerman, 2000) in primary school (Dignath et al., 2008), elementary school (Dignath and Büttner, 2008) or at university (Sitzmann and Ely, 2011).

With the aim of explaining how each of the aforementioned variables influences the learning process, various proposed SRL models involve different constructs, phases, strategies, and inter-connected micro-processes (e.g., Schunk, 1994; Winne and Hadwin, 1998; Pintrich, 2000; Zimmerman, 2000; Corno, 2001). Winne and Hadwin (1998) model has four phases: definition of learning tasks, setting goals and plans, studying tactics, and metacognitive adaptations. Influenced by the information-processing theory, this model dwells on cognitive processes that evoke learners' SRL. In Zimmerman (2000) three-phase cyclic model, there is a marked distinction between SRL processes and SRL strategies, which involve forethought (task analysis & self-motivation beliefs), performance (self-control & self-observation), and self-reflection (self-judgment & self-reaction) phases. Originating from social-cognitive theory, this model highlights the interplay among the motivational (meta)cognitive, and behavioral aspects. The phases are cyclical, as students make use of feedback on their current learning experiences to adjust to future ones (Zimmerman, 2000). Schunk (2014) also considers that it is appropriate to view SRL as a cyclical process because personal, motivational, behavioral, and contextual factors usually change during each phase of learning. Pintrich (2000) argues that, despite their distinctive features, all the suggested models share certain characteristics. For example, in all, learners are active and responsible for their own learning, (2) have the potential to monitor, adjust and control their learning, (3) use a criteria/standard to check whether they have achieved their learning objectives; and (4) SRL functions as a mediator among learners, context and achievement to foster the process of learning.

The large number of studies on SRL over many years (Schunk and Zimmerman, 1996; Cleary and Kitsantas, 2017) reflect its impact on students' academic success. It has been observed that self-regulated learners show more satisfactory performance and achievement at school (Boekaerts et al., 2000). With high intrinsic motivation and task interest (Pintrich, 1999), they can take a goal-directed approach to learning objectives and actively take on problem-solving initiatives (Hall et al., 2002). Previous research also shows that those who successfully self-regulate their learning can seek help from others, such as peers, parents, and teachers, and learn more as a result. They also develop an ability to master the given learning activities more proficiently and automatically (Vermunt and Verloop, 1999). Furthermore, they hold a strong image of themselves as a person who is motivated, hardworking, strategically flexible, and academically competent (Meltzer et al., 2001). It could be mentioned that SRL skills are of critical value, not only for academic success, but also for affective aspects of individuals' learning, such as emotional and spiritual well-being (Chen and Wu, 2021; Holzer et al., 2021). Further, research on SRL is known to range from students in elementary school to college level. This means that SRL could be taught to a wide spectrum of individuals from elementary (Stoeger and Ziegler, 2011) to college levels (Hong et al., 2021; Wolters and Brady, 2021).

## 1.2. Teaching and assessing self-regulated learning

For successful SRL teaching, first of all, teachers need to change their understanding of their role, behavior, instructional beliefs, values, and practices (Lombaerts et al., 2009). For this change to occur, teachers need to (1) renew their vision on teaching and learning, (2) be determined to learn more about this new way of teaching, (3) adjust their existing teaching skills, (4) reflect and (5) collaborate with colleagues (Shulman and Shulman, 2004). Unlike the traditional classroom, in which the focus is on the 'general' content and the pace

and progress of the 'whole class', the teacher aiming to foster students' SRL needs to assign the control of the learning process to the 'individual' student. This involves altering the environmental conditions to help students make choices and plans, exercise volitional control, seek information and assistance, self-reflect, and evaluate (Perry et al., 2008).

Teaching SRL, which requires the instruction of learning strategies and creating an appropriate learning environment (Dignath and Büttner, 2008), can be achieved implicitly or explicitly. In the former method, students are provided with models and prompts for the target skills and behaviors but without being informed of their strategic importance (Dignath-van Ewijk et al., 2013). In the explicit method, students are given the direct instruction, justification, and elaboration on the target strategies. Teachers openly explain how, why, and when it is important to use those strategies (Kistner et al., 2015). In addition to these methods, SRL can be taught in a classroom context by creating an optimum learning environment. This new method has the following characteristics: (1) challenging learners with engaging and meaningful activities; (2) giving them more autonomy with the options of what to do, with whom, how, and where; (3) providing scaffolded assistance; and (4) encouraging students to self-evaluate their own learning (Perry, 1998). Considering SRL teaching methods, Perry (2013) states that all such instructional and social interventions need to be dynamic in nature because SRL teaching should be based on students' specific needs and characteristics to cultivate their self-regulation.

Many instruments have been developed to assess learners' SRL by particularly focusing on its metacognitive, motivational, and behavioral constructs (Koivuniemi et al., 2021). For example, Weinstein et al. (1987) created a self-report inventory, Learning and Study Strategies Inventory (LASSI), with 80 items pinpointing students' strategies. Another questionnaire, the Motivated Strategies for Learning Questionnaire (MSLQ), was developed by Pintrich et al. (1993) to measure SRL *via* its 81 items. This questionnaire dwells on learning strategies and motivation. A third instrument is the Self-Regulated Learning Interview Scale (SRLIS) created by Zimmerman and Martinez-Pons (1986) through which students were asked to respond to six problem contexts, and their answers are coded into 14 self-regulatory categories. Zimmerman and Martinez-Pons (1986) listed these SRL strategies as follow: (1) self-evaluation, (2) organizing and transforming, (3) goal setting and planning, (4) seeking information, (5) keeping records and monitoring, (6) environmental structuring, (7) self-consequences, (8) rehearsing and memorizing, (9) seeking social assistance from (9a) peers, (9b) teachers, and (9c) adults, and (10) reviewing (10a) tests, (10b) notes, and (10c) textbooks. In addition to the self-reports and structured interviews, teacher judgments and ratings have been employed to assess students' SRL because teacher ratings are reliable when implemented accurately (Winne and Perry, 2000). Observing SRL performance is another form of measurement. Such a performance assessment should focus on the observable marks of cognition that learners unveil when working on a task. These traces involve the concept maps they create, the salient points they extract, or the ideas they underline. One important advantage of this approach is that learners are observed and assessed "in context" during the process of their learning (Zeidner and Stoeger, 2019).

## 1.3. Teaching self-regulated learning through role modeling

In the social cognitive theory, Bandura (1989) underscores the importance of role models because individuals learn both behaviors and

cognitive strategies by observing and emulating the target behaviors and strategies (Bandura, 1986). Considering the important balance between children's cognitive and affective domains during the developmental period, role modeling appears to be an optimum strategy. In harmony with this balance, for students, role models possess both mental and emotional aspects (Kar et al., 2013). Additionally, role models allow students to have vicarious experience (Bandura, 1997), which helps them reduce their stress and brings about successful emulation of the role models (Schunk, 1989). Role models also inspire individuals with hopes and aims that they would not otherwise aspire to (Lockwood and Kunda, 1999). Students can notice the target characteristics and strategies of given role models. Further, they might purposefully select among them, and may come to realize that those abilities and/or behaviors are not fixed (Morgenroth et al., 2015). Such awareness has the potential of improving students' self-efficacy, motivation, and expectations of success. This, in turn, results in better performance and more learning (Schunk, 1989), which is the ultimate aim of SRL. The greater the exposure of students to positive role models, the more they develop their SRL skills (Karaca and Bektaş, 2021). However, it needs to be pointed out that role models for students are not only teachers, and role modeling could be provided through individuals other than teachers.

Zimmerman (2000) argues that students are able to shift from cognitive role modeling to self-direction once a model has been identified. This transfer consists of four levels, the first two of which focus on the social, and the last two, on the self. In the observational level, students watch a model to learn what to perform. At the emulation level, they copy the model in general when engaged in a task similar to that of the model. However, these two levels are not enough to gain a target skill since students need to move beyond copying the model or their teacher and become involved in new tasks by themselves. In the third level, which is called the self-controlled level, self-regulatory skill is achieved when students practice and display the target skill in a structured setting without the presence of the role model. Learning processes are given priority over student products in this phase. The final level, the self-regulated level, requires learners to demonstrate how adaptive they are at using the target skill in various contexts independent of the role model. As clearly seen, this multilevel sequence of self-regulatory development begins with role modeling; and ends with developing SRL skills. Research indicates an overwhelming desirability and necessity of SRL and teachers' role in actualizing students' learning (Thomas et al., 2022).

In a study by Dignath and Büttner (2018) on primary and secondary school teachers' use of SRL strategies, teachers were observed through videorecording, with follow-up interviews. Findings showed that although secondary school teachers implemented more direct cognitive strategies, primary school teachers were more successful in preparing implicitly more conducive SRL environments for their students. The highest-rated teacher during the observations demonstrated direct role modeling of cognitive strategies in more than half of his teaching time; that is, he spent the most time modeling the use of cognitive strategies. This is also in harmony with the findings that teachers' indirect promotion of SRL significantly correlate with students' learning performance following the observed lessons (Kistner et al., 2010). In addition, Moely et al. (1992) conducted a study on teachers' role in facilitating memory, and study strategy development in elementary school students and focused in part on teachers' strategy-suggestion to students through direct role-modeling, such as modeling how to solve a problem and its applicability. The researchers found that teachers at

grades 2 and 3 made higher numbers of strategy suggestions than did teachers at either lower (grade level 1) or higher levels (grade levels 4–5).

Horsburgh and Ippolito (2018), seeking to understand how role modeling functions in clinical settings, conducted through interviews with six final year clinical students and five clinical teachers. They revealed that students learned from direct and vicarious reinforcement, although it required sustained efforts to keep consciously observing role modeling teachers, retaining, and trying out the skills demonstrated, and finding the motivation to imitate their teachers. The clinical teachers explained that role modeling was effective; however, most modeling of teaching strategies was not done consciously, in other words, the modeling was consistent or deliberate, and did not involve deep understanding of students' cognitive processes.

With all the accretion in the literature and case studies on role modeling, this present work aims to reveal in-service teachers' observed practices and experiences throughout a professional development seminar on SRL, in particular, role modeling. The research question is: what implications of role modeling as a strategy of SRL could be observed in designed, evaluated, and implemented lesson plans, in given expert feedback and in online student products in a K-12 teachers' professional development training program?

## 2. Methodology and methods

This mixed-methods case study incorporated supporting data from the discourse of the role modeling strategy implementation phase. The quantitative data were obtained from the participant teachers' lesson plans using the rubric developed by the researchers. Qualitative data were obtained from a theoretical thematic analysis of the lesson plans, expert feedback, and online student products. As the case used for the study, this professional development training, was particularly designed for in-service K-12 teachers to help them promote SRL skills through role modeling. In this training, integrating SRL skills through role modeling was one of the four main pillars (the others were 'use of cognitive strategies', 'self-questioning', and 'monitoring'). The participant teachers were given training on a particular SRL strategy (i.e., role modeling) and asked to present their lesson plan before getting training on any other strategies like self-questioning, monitoring, or cognitive strategies. Since 'role modeling' was the first SRL strategy that the teachers were involved in, it can be clearly stated that there was no

interference of the other SRL strategies on the findings or conclusions of this study, which solely focused on 'role modeling'.

## 2.1. Self-regulated learning professional development program

The self-regulated learning professional development program lasting 16 weeks was designed by the researchers of this study as a long-term and interactive in-service teacher training. The training program included four themes involving how to use *role modeling*, *cognitive regulation*, *self-questioning* and *monitoring* as SRL strategies. In this study, the researchers examined only the first theme, which was role modeling. The learning community framework (Lave, 1991; Palincsar et al., 1998) and strategic content learning approach (Butler, 1998) were adopted in the design of the program flow and content (Butler et al., 2004) in order to encourage the teachers to discuss teaching practices, to create conceptual knowledge, and to make revisions where and when necessary, as shown in Table 1.

The first half of the program focused on understanding SRL, making inferences from experiences, and reflective thinking activities on teaching practices. Self-regulation, metacognition, emotional regulation, and particularly motivational regulation were determined as weekly-focused topics in problem-solving, learning, and teaching. In the second half of the program, trainers focused on providing the teachers with knowledge, skills, and strategies to be utilized in teaching processes to improve students' SRL skills. Throughout the interactive trainings, the teachers were presented with practical and evidence-based strategies to help students participate in their own learning, develop their thinking habits, effectively control their problem-solving processes, and reflect on their own learning.

The teachers were asked to develop and implement lesson plans focusing on these topics and write a reflection report upon their practice. They were also encouraged to blend different strategies in a lesson plan they prepared. The trainers gave feedback on the teachers' lesson plans before and after the implementation; and they were able to share their teaching experiences during an online discussion day.

The presence of an online space (Google Classroom and Google Site) to share lesson plans also led to the formation of a virtual community of practice where the teachers could see their colleagues' lesson plans. It was also ensured that the assigned tasks supported teachers' self-regulated participation (Butler et al., 2004). Delivered

TABLE 1 SRL professional development program.

| Phase | Topics | Tasks | Delivery mode and duration |
|---|---|---|---|
| Introduction | What is SRL? | Suggested readings for teachers. | Asynchronous and Synchronous – 1 week |
| | Teacher as a self-directed learner. | Teacher self-evaluation ad reflection reports on SRL experiences + Readings | Asynchronous – 1 week. |
| | Teacher as a self-directed teacher | Lesson plans: analysis and reflection. | Asynchronous – 1 week |
| *Theme-focused phase | Theoretical and practical introduction | Interactive materials for teachers Preparing a lesson plan | Synchronous and Asynchronous – 1 week. |
| | | Trainer feedback + Implementation on lesson plans. | Asynchronous – 1 week. |
| | | Reflection on lesson plans. | Synchronous and Asynchronous – 1 week. |
| Closing | Wrap-up workshops | Re-implementation + Best Practice Presentations | Synchronous – 1 week |

*This phase includes all four themes successively, namely role-modeling, cognitive regulation, self-questioning and monitoring.

in a fully web-based hybrid fashion, the modules were presented through the Zoom in two synchronous sessions and through a Web 2.0 interactive video tool (Nearpod) in three asynchronous sessions. The asynchronous sessions, conducted through Nearpod interactive video recording tool, were uploaded to Google Classroom where trainers and teachers communicated and shared relevant documents. Before each synchronous meeting and the asynchronous videos, the relevant content and readings were shared with the teachers through a content management system (Google Classroom). For the asynchronous part, one trainer recorded a video of the target content presentation with embedded discussion questions that required responses from the teachers. Each video had three in-video embedded questions including open-ended and multiple-choice ones. The teachers watched and responded to the videos individually before they started writing their lesson plans. Then, the teachers and the trainers gathered in groups for 2 h each week to discuss their lesson plans, direct their questions to the trainers and share experiences with colleagues. In each two-hour synchronous meeting, in addition to brainstorming and idea-sharing on the subject matter, the teachers worked in groups so that they could benefit from a learning community experience.

The researchers of this study, both/all academics at state and foundation universities, were also the trainers in this professional training. They have both expertise and experience of a minimum of 10 years, particularly in SRL, teacher assessment, educational technology, and teacher training. They have national and international publications in the fields mentioned above; and were involved in designing and delivering many teacher-training programs for various institutions. Each trainer took an active role in the present SRL training through the design, development, implementation, evaluation, and reporting stages.

## 2.2. Participants and setting

Of 80 teachers who were involved in the training program, the participants of this study were 16 K-12 teachers working on four different campuses of the same private educational organization. They are all Turkish nationals between the ages of 29 and 45, teach at kindergarten, primary, middle, and high schools. One teacher had 20 years of teaching experience, one teacher had 4 years, seven had between 11 and 15 years, five had between six and 10 years, and two, 16 years. None of them received any training on SRL strategies earlier. The foundation school where they work has a history of more than a 100 years.

In the overall training program that included four themes, 80 participants presented (a) 16 lesson plans involving how to use *role modeling* as an SRL strategy, (b) 34 lesson plans focusing on *cognitive regulation*, (c) 34 lesson plans on *self-questioning* and (d) 26 lesson plans on *monitoring*. Peculiar to this study, 16 lesson plans on role modeling strategies, excerpts from expert feedback and student products were examined through thematic analysis.

The consent for activities to improve student learning strategies and enhance their academic gains are included in a contract between the foundation school and parents signed every new school year. This contract also referred to the year-long activities in which the present SRL training was included. The website was also open to parents' inspection and observation regarding the types of development activities available for their children at the school.

## 2.3. Data collection and analysis

As the main data source, the lesson plans produced both qualitative and quantitative data. Inductive coding analysis of lesson plans provided a bottom-up perspective and allowed the researchers to observe and understand the teachers' transfer of role modeling strategy training. Additionally, using a specially prepared rubric, the researchers evaluated lesson plans and added a top-down aspect (Braun and Clarke, 2016). The combination of deductive (top-down) and inductive (bottom-up) dimensions was complementary rather than contradictory (Woiceshyn and Daellenbach, 2018). In addition to the plans, the researchers were provided with further qualitative data in the form of expert feedback given on the lesson plans and student products displaying the impact of this professional training.

After receiving the weekly training by watching the recorded videos and attending a live broadcast on zoom, the teachers were required to use the newly learnt skills and strategies in the following week's lesson plan, and then in their classroom teaching. The lesson plans involving role modeling strategy ($n = 16$) were uploaded to the Google Classroom by the teachers and were analyzed by two researchers using the rubric. The rubric was constructed from its draft to final version based on the related literature and expert opinions. Searching through the available literature on role modeling, the researchers arrived at eight relevant items for the rubric. These items of role modeling criteria were determined as in the following:

1. Teacher setting a role model from the class
2. Teacher setting a role model outside the class
3. The students working on a role model
4. Giving feedback on the students' role modeling
5. Making a link between the role model(s) and lesson objective(s)
6. Referring to the students' cognitive development *via* the role model(s)
7. Referring to the students' affective development *via* the role model(s)
8. The harmony between role modeling and other SRL strategies

Then, evidence for each of these eight items was sought in the lesson plans and student products which composed the deductive aspect of the study. Three professors in educational sciences and a post-doctoral researcher worked collaboratively to improve the reliability of the rubric. Synchronous and asynchronous discussions were conducted to optimize the rubric quality for internal and external validity. To evaluate the reliability between the two raters, the intraclass correlation coefficient (ICC) was measured; and it was observed that there was a strong correlation between the two raters as the ICC value was 0.93.

Inductive coding is associated with no existing assumptions, and coding that requires a pure induction from scratch (Saldana and Omasta, 2017). Thus, the inductive coding analysis of the lesson plans and expert feedback enabled the researchers to unveil the emerging themes (Braun and Clarke, 2016). Through open, axial, and selective coding, all the qualitative data were analyzed to identify certain common themes. Rather than waiting for the end of the data collection, the researcher conducted qualitative analysis concurrently (Morrison et al., 2002). Following the content analysis, peer debriefing was conducted to ensure credibility and trustworthiness (Creswell, 2002). The two researchers who examined the lesson plans through the rubrics were different from the ones who unveiled the themes; however, the congruency and consistency of the results shows the reliability of the data analysis process in this study.

TABLE 2  Level-subject-role model in the lesson plans.

| Lesson plans | Grade level | Subject | Topic | Role model |
|---|---|---|---|---|
| 1 | Kindergarten | | Regions of our Country | *Bart Manny (a famous musician) |
| 2 | Primary | English | Leadership | Helga the Student & Role models suggested by the students |
| 3 | Primary | Social Sciences | National Festival | The founder of the country |
| 4 | Primary | Language | Habit of Reading | The founder of the country |
| 5 | Middle School | Science | Models of Atom | Dalton, Thomson, Rutherford, Bohr, Schrodinger (the leading atomic scientists) |
| 6 | Middle School | Social Sciences | Innovative Ideas in the Field of Economy | *Nathan Demmy (an industrialist) |
| 7 | Middle School | Science | Human & Environment | Greta Thunberg (an environmental activist) |
| 8 | Middle School | Social Sciences | Citizenship | *Teacher Danny (outside the class) |
| 9 | Middle School | Social Sciences | Training Craftsman | An expert & an apprentice in a guild |
| 10 | Middle School | Math | Calculating the Mean | Model characters in a video |
| 11 | Middle School | Math | Data Collection & Evaluation | The teacher of the class |
| 12 | Middle School | Social Sciences | Immigration | The teacher of the class & Students themselves |
| 13 | High School | Math | Pi Number | Archimedes |
| 14 | High School | Biology | Cell Division | Gregor Mendel |
| 15 | High School | Chemistry | Carbon Footprint | The teacher of the class |
| 16 | High School | Chemistry | Climate Change | Greta Thunberg |

*Pseudonyms were used for the names stated in the items 1, 6 and 8.

Further, student products were reviewed to reveal the traces of role modeling strategy use. Since the products were in digital formats, such as discussion boards, galleries, infographics and other collaborative learning outputs, the researchers were able to access them whenever necessary.

In sum, multiple data collection instruments were employed to increase the credibility and trustworthiness of the study. All the three sources of data were combined and triangulated to answer the research question, and the similarities between the results of the qualitative and quantitative analyses clearly show the reliability of this study.

# 3. Results

The qualitative data gathered from the lesson plans, expert feedback, and online student products through theoretical thematic analysis are presented in Tables 2–5. Also displayed in Table 6 are the quantitative data gathered through the SRL strategy of the role modeling rubric (Appendix A) which helps to demonstrate the use and value of role modeling as a strategy in teaching SRL.

As presented in Table 2, 16 lesson plans in three grade levels and seven different subjects were analyzed in detail. The target subject matter and contents were different in each lesson plan. There was also a wide variety of role models presented by the teacher or the students, both inside and outside the class.

## 3.1. SRL strategy of role modeling rubric results

The scores given to item 1 and item 2 showed that 13 teachers set a role model outside the class, and three, inside the class. Item 3 displayed that in

addition to the role model given by the teacher (Helga the Student), the students were also encouraged to give their own role models in Lesson Plan #2 (LP2) and set themselves as role models as their teacher did in L12. In 15 of the lesson plans, there was a reference to the elaboration on the models by the students and/or the teacher.

As seen in Table 6, considering the scores given to item 4, it is clear that there was an adequate reference to giving feedback on the students' role modeling in eight lesson plans; and in four, the students were also involved in this feedback process. The link between the role models and lesson aims appeared in all the lessons (item 5). Seven out of 14 lessons were awarded 'above average' regarding this aspect. Item 6 denotes that there was some reference to the students' cognitive development *via* the role model(s) in all the lesson plans. Item 7 demonstrated that the role models stimulated the students' affective domain in 11 out of 16 lessons: four lessons were awarded with 'above average'; four with 'average; and three with 'below average'. Item 8 points out the harmony between role modeling and other SRL strategies in all the lessons. In this regard, four of the lesson plans were given 'standard' and 12, 'above average'.

## 3.2. The unveiled themes

The researchers of this study analyzed and repeatedly revisited the qualitative data to unveil the common themes. The examples set the foundation for creating codes, and the codes helped to generate the themes. Reducing the examples for each code, Table 3 displays a shortened version of the theme-code-example matrix.

Technology is expected to boost the process of SRL when learners practice skills such as monitoring, organizing, and evaluating their learning (Mooji et al., 2014). Likewise, in this study, all the teachers

TABLE 3  The theme-code-example matrix.

| | Theme | Code | Example |
|---|---|---|---|
| 1 | Teachers as agents to improve students' self-regulated learning skills through role modeling | Students becoming active and presenting a product | *Like Bart Manny, the students prepare a video to introduce a different region of their country (L1). *Like Teacher Danny, the students were asked to plan a social project to help the street animals in their neighborhood (L8). |
| | | Students having a vicarious experience through role models | *Greta Thunberg's struggle to protect the environment (L7 & L16), *The founder of the country's passion for reading (L10). |
| | | Students working in pairs or groups | *The students worked in pairs and solved the problems by following the steps set by Archimedes (L13). *The students worked on an atomic model in five groups, one each for?? Dalton, Thomson, Rutherford, Bohr, Schrödinger (L5). |
| | | Teacher's metacognitive awareness of role modeling reflected in the lesson plans | "Role modeling aimed to encourage the students to empathize with young entrepreneurs" (L6). "Role modeling has been selected as it increases motivation and helps to integrate other SRL strategies" (L7). |
| | | The role models that the students could imitate or relate themselves to | *The video on the founder of the country will definitely help the students relate themselves to the topic better (L3-Expert Feedback). *Gregor Mendel is the right role model for this lesson (L14-Expert Feedback). |
| 2 | Role modeling as a key to learning-centered lessons | Role modeling that fosters students' cognitive development. | * They evaluated the current environmental situation in their neighborhood, adopted a critical lens on the potential options and produced innovative ways to protect the environment like Greta Thunberg (L7). *The students created a concept map on the causes of immigration and wrote a letter in which they set themselves as a role model on how to treat immigrants (L12). |
| | | Role modeling that fosters students' affective development. | *The students were encouraged to present the photos of the street animals in their neighborhood and share how they felt (L8). "It was very effective to create such an environment that involved both your and your students' feelings" (L7-Expert Feedback). |
| | | Role modeling strategy that helps to achieve the lesson objectives. | *Nathan Demmy helps them notice how to contribute to the economy with innovative ideas in the field of economics (L6). *Teacher Danny showed how to behave as a responsible citizen (L8). |
| | | Role modeling that complies with the tenets of constructivism. | *Setting a meaningful and authentic context (In L14, Gregor Mendel and his studies set a concrete context to understand how DNA controls growth). *Creating a reflective learning process (In L15, the students reflected on their efforts to reduce their carbon footprint like the role model given). |
| 3 | Role modeling as a strategy to integrate various SRL skills into a lesson | Goal setting, organizing, seeking information, seeking social assistance, time management, self-questioning, self-monitoring, self-reflecting, transferring. | Goal setting (L1), Self-questioning (L15), Self-monitoring (L3), Time management (4), Self-reflecting (L5), Transferring (L14), Seeking social assistance (L9), Organizing (L6), Seeking information (L13). |

TABLE 4  SRL skills and selected technologies in the lessons.

| | SRL skill | Technology |
|---|---|---|
| 1 | Goal setting | Google Classroom (L13), Google Forms (L14) |
| 2 | Organizing | Mindmeister (L4, L14), Quiver (L5), Canva (L6, L7), Flipgrid (L1, L16), Storyboard (L9), Padlet (L11, L12) |
| 3 | Seeking information | Geogebra (L13), Padlet (L5), EdPuzzle Video (L5, L6, L7, L12), SebitVCloud (L10, L8) |
| 4 | Seeking social assistance | Breakout Rooms (L14), Mentimeter (L16), Nearpod (L14, L3), Padlet (L1), Google Slides (L7) |
| 5 | Self-questioning | E-Tables (L13), Mentimeter (L6) |
| 6 | Self-monitoring | Padlet (L1, L2) Jamboard (L7) |
| 7 | Self-reflecting | Google Forms (L5, L11, L13), Quizizz (L14, L15), Wordwall (L5), Wizer.me (L6, L3), Google Classroom (L7) |

integrated many e-tools and software to maximize the students' SRL process as seen in Table 4.

# 4. Discussion

This section presents the discussions of the major findings of this study considering the research question in light of the related literature and the conclusions drawn. Based on all the data, it is crucial to note that this professional training, particularly designed and implemented for in-service K-12 teachers, resulted in a meaningful change in participants' SRL teaching through role modeling strategy. SRL has a complex and multifaceted nature (Baumeister and Heatherton, 1996), therefore, rather than presenting this chapter in a monolithic format, it was considered more appropriate to divide the arguments as follows:

1. Teachers as agents to improve students' SRL skills through role modeling.
2. Role modeling as a key to learning-centered lessons.
3. Role modeling as a strategy to integrate various SRL skills into a lesson.

TABLE 5 Social assistance in the lessons.

| Whole-class interactions | | Group work | Pair work |
|---|---|---|---|
| Face-to-face | Online | | |
| L2, L10, L6, L9 | L8, L4, L11, L12, L15 | L1, L3, L5, L7, L14, L16 | L13 |

TABLE 6 SRL strategy of role modeling rubric results.

| Grade levels | Lesson plans | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Kindergarten | 1 | 0 | 3 | 0 | 2 | 3 | 3 | 3 | 3 |
| Primary | 2 | 0 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| | 3 | 0 | 3 | 0 | 2 | 2 | 1 | 1 | 3 |
| | 4 | 0 | 2 | 0 | 1 | 2 | 2 | 2 | 2 |
| Middle school | 5 | 0 | 2 | 0 | 3 | 2 | 2 | 0 | 3 |
| | 6 | 0 | 3 | 0 | 2 | 3 | 2 | 2 | 3 |
| | 7 | 0 | 2 | 0 | 3 | 3 | 3 | 2 | 3 |
| | 8 | 0 | 3 | 0 | 0 | 2 | 3 | 3 | 3 |
| | 9 | 0 | 2 | 0 | 0 | 2 | 2 | 2 | 2 |
| | 10 | 0 | 3 | 0 | 2 | 2 | 3 | 0 | 3 |
| | 11 | 3 | 0 | 0 | 2 | 2 | 3 | 0 | 3 |
| | 12 | 3 | 0 | 3 | 2 | 2 | 2 | 3 | 2 |
| High school | 13 | 0 | 2 | 0 | 2 | 3 | 2 | 0 | 3 |
| | 14 | 0 | 2 | 0 | 2 | 3 | 3 | 0 | 3 |
| | 15 | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 3 |
| | 16 | 0 | 3 | 0 | 0 | 2 | 3 | 3 | 3 |

3 = Above Average, 2 = Average, 1 = Below Average, 0 = None.

## 4.1. Teachers as agents to improve students' self-regulated learning skills through role modeling

No teacher can deny the importance of equipping students with SRL skills; nevertheless, a great majority know neither exactly what to teach nor how (Perry et al., 2008). Thus, this research, and many teacher training and teacher education programs have focused on SRL (Lunenberg and Korthagen, 2003; Miller et al., 2009; Tonks and Taboada, 2011). Just as Dignath and Büttner (2008) argue that teaching SRL strategies helps students gain such skills, this study has also demonstrated that the ability to practice SRL is not innate or a default, but can and should be taught, in particular, through role modeling (Merino and Aucock, 2014).

This research showed the main reasons why role modeling is an appropriate strategy to gain SRL skills. Firstly, the role models in the lesson plans were given as a source for the students' observation and emulation (Bandura, 1986). The rubric results (items 1 and 2) show that 13 teachers set a role model outside the class and three inside the class; 15 of them involved elaboration on the models presented. Although teachers can also act as role models in implicit SRL instruction (Kistner et al., 2010; Dignath-van Ewijk et al., 2013), the great majority of the teachers in this study did not set themselves as role models, which is supported by Lunenberg et al. (2007) and

Vrieling-Teunter (2012) argument that even teacher educators find it difficult to serve as a role model when teaching SRL. The role models given in the lessons had a positive impact on students' motivation, expectations of competence, self-efficacy, desire to be successful and new behaviors (Lockwood and Kunda, 1999; Morgenroth et al., 2015). The student products which were available on their online platforms demonstrated that role modeling helped to inspire students, achieve competence in completing the given tasks, and served as a mental guide for success. For instance, in L6, the students prepared 'Show Yourself' poster presentations as young entrepreneurs; in L5, they presented their atomic models similar to those of a particular atomic scientist; and in L4, they created an infographic displaying the reasons why the young tend not read and suggestions for overcoming this issue. There was also positive feedback on the well-selected models in the expert feedback, such as "The video on the founder of the country will definitely help the students relate themselves to the topic better" (L3), "Gregor Mendel is the right role model for this lesson" (L14) and "Greta is an activist that many students already know well on social media, so she is an appropriate choice" (L7). Since all the students and teachers belonged to the same nationality and culture, when selecting the role models, the teachers considered not only the teaching content, but also the characteristics of their student group.

The second reason why role modeling is an optimum strategy for SRL skills is that, as Bandura (1997) stated, this method provides vicarious experience. To illustrate, the students experienced Greta Thunberg's struggle to protect the environment (L7 & L16), the founder of the country's passion for reading (L4) and Teacher Danny's project to help street animals (L8), which made them appreciate other people's successes and want to perform like them (Lee et al., 2021). That vicarious experience also helped reduce students' stress and led to successful emulation of the role models (Schunk, 1989). To give an example, in Lesson 2, the teacher added his reflections to the plan, stating that "while explaining their choices of leader for the Martian Conundrum, they got so excited that they would turn on their microphones and talk without waiting for their turn."

Identifying a role model was not an aim itself, but a strategy to set a clear path for the students. As clearly seen in the lesson plans, the learners were guided towards SRL once a model was identified (Zimmerman, 2013). It was easy to notice the four changes in levels in the shift from role modeling to SRL (Zimmerman, 2013). At the observation level, the students learned about a model and elaborated on the model's target characteristics. For example, in L1, the teacher let the students watch a mini-TV series on Bart Manny and elicited 'researching', 'exploring' and 'questioning' as his leading characteristics. In the emulation level, the students were encouraged to copy the way Bart Manny prepared his TV program. After the model was given, the students were asked to prepare a similar short presentation. In order to accelerate this level, the students were given the opportunity to receive social support and to seek help in groupwork. They were also given sufficient time because acquiring a target skill demonstrated by a role model requires extensive practice (Ericsson and Lehmann, 1996). In the self-controlled level, the students were given the chance to apply the target skills in a structured way without working on the role model. The fourth level was the self-regulated learner level, in which the students triggered their SRL skills by identifying a region to introduce (setting goals), googling (seeking information), asking their peers (seeking social assistance), keeping to time limit (time management), checking their progress (self-monitoring) and assessing their performance after trials (self-reflecting). Notably, this study showed how role modeling enabled

the smooth transition from working with role models to acquiring target SRL skills.

As Winne and Hadwin (2008) highlighted, raising teachers' awareness of the potential effects of their own SRL strategy practices on students is a significant step in creating effective and tailored learning environments. In this study, teachers often reflected on their metacognitive awareness of role modeling in their lesson plans, stating, "Role modeling aimed to encourage the students to empathize with young entrepreneurs" (L6), "Role modeling has been selected as it increases motivation and helps to integrate other SRL strategies" (L7) and "Role modeling is implemented as it strengthens the other SRL strategies since it makes the concepts more concrete and easier to understand for the students" (L8). All these demonstrated that the teachers were aware of its importance and knew how to implement it as an SRL strategy. The most marked point is that they not only described how to use role modeling in their lesson plan but were able to justify the underlying logic by elaborating on the contributions of role modeling to their students' learning process. In other words, more than half of the lesson plans were not in the descriptive level, which simply described how to use role modeling, but in the critique level, which involved both description and elaboration on the function of role modeling as an SRL strategy. This shows that their professional training made them more than mere practitioners, teachers who can see beyond the surface. Thus, their metacognitive awareness could be regarded as one of the main reasons for the successful implementation of this SRL strategy in their lesson plans.

Many studies on SRL demonstrate the difficulties of teaching children under the age of 10 to carry out cognitive and metacognitive processes, and these difficulties hinder becoming a self-regulated learner (Winne, 1997; Zimmerman, 2000). Although the rubric results of this research do not guarantee the students' performance as self-regulated learners, they still show that the lesson plans, especially in the kindergarten and primary levels (L1, L2, L3 and L4), can be better designed to help students gain self-regulated learning skills. The experts' positive feedback on those lesson plans also confirms how well-designed they were. To illustrate, before giving details, the expert started feedback for L3 with the statement that "it was hard to miss the glimpses of SRL in every inch of the lesson plan."

In addition to level-independent aspect of SRL, another unique outcome of this study is that role modeling can be used as a SRL strategy, regardless of subjects. Various lesson plans presented the details of how to implement this SRL strategy for different topics in different subjects, such as leadership in English (L2), youth festivals in Social Sciences (L3), calculating the mean in Math (L4), models of the atom in Science (L5), cell division in Biology (L14) and carbon footprints in Chemistry (L15). Blending the teaching of SRL into academic content is particularly relevant, since the SRL trainings with the most satisfactory results are the ones that are integrated with academic content and practiced in the classroom to foster students' SRL development (Perry, 1998; Winne and Hadwin, 2008).

## 4.2. Role modeling as a key to learning-centered lessons

Many researchers argue that SRL is at the core of learning-centered pedagogy and successful learning in school (Boekaerts, 1999; Zimmerman, 2001; Prince and Felder, 2006; Butler et al., 2013) due to its focus on responsibility, and organizing and completing tasks under

the scaffolded facilitation of the teacher (Otara et al., 2019). Similar to Bandura (1989) finding that students learn both behaviors and cognitive strategies by observing others, this study showed that as an SRL strategy, role modeling helped to promote learning-centeredness is lessons by fostering cognitive and affective development. It is clear that in all the lesson plans, the role models encouraged the students to exert cognitive effort and become mentally alert in tasks that required higher-order thinking skills such as analysis, evaluation and creation (Bloom et al., 1956). For example, in L5, the students were encouraged to think like the scientist assigned to their group as a cognitive role model, and to analyze an atom model accordingly. In L7, they evaluated the current environmental situation in their neighborhood, focused a critical lens on the potential options and produced innovative ways to protect the environment in the manner of Greta Thunberg. In L12, the students created a concept map on the causes of immigration and were assigned to write a letter in which they cast themselves as role models on how to treat immigrants. Thus, it can be stated that the suggested constructivist instructional methods and techniques in the lesson plans aimed to improve the students' intellectual and SRL skills (Schaw et al., 2006). Complying with the tenets of constructivist learning (Ertmer and Newby, 1993), the role models

- helped the students activate their related schemata (In L4, the video on the founder of the country set a starting point for the students to activate their related prior knowledge)
- created a reflective learning process (In L15, the students reflected on their efforts to reduce their carbon footprint in the manner of the role model given)
- enabled the students to move beyond the given information (In L7, Greta Thunberg's struggle to protect the environment encouraged the students to prepare a plan to protect their own neighborhood)
- set a meaningful and authentic context (In L14, Gregor Mendel and his studies created a concrete context to understand how DNA controls growth)
- assigned to the teacher the role of a mediator and facilitator (In L5, the students worked in groups to analyze the atom model from a particular atomic scientist's lens under the limited guidance of the teacher)
- encouraged the students to be aware of multiple perspectives (In L3, after watching a video on the founder of the country, the students answered the question of "Which of his characteristics do you relate yourself to?")

In addition, in the rubric results, it was clear that the role models had encouraged the students to focus their mental energy on the lessons (item 6). Markedly, eight out of 16 lessons were given above average, proving the use of role modeling as an effective strategy for the learners' cognitive development.

The interplay and balance between cognitive and affective domains are of paramount importance for SRL during the developmental period, especially for children and adolescents (Kar et al., 2013). In this study, apart from the focus on the students' mental abilities as stated above, the particular attention given to the students' affective domain was very visible in the lesson plans, expert feedback and rubric results. Students' feelings, emotions and attitudes were considered in the lesson plans. For example, like the role model Teacher Danny, the learners were expected to present photos of the street animals in their neighborhood and express their feelings on these in L8. Likewise, in L12, they were asked to express their views

on immigrants. The teacher also set himself as a role model on how to reflect on their feelings in an appropriate way in that lesson. In addition, in the expert feedback, there was positive feedback on the link between the selected role models and the learners' affective development. For example, for L3, the expert stated, "The founder of the country set an optimum role model that your leaners can make personal connections with"; and for L12, he stated that "it was very effective to create such an environment that involved both your and your students' feelings." The rubric results (item 7) also demonstrated that the selected role models activated the students' affective domain in 11 out of 16 lessons (four lessons with above average, four with average and three with below average).

Another point to confirm the key part that role modeling plays in learning-centered lessons is analyzing whether this approach serves to accomplish lesson objectives. As clearly noticed in the lesson plans, role modeling strategy also helped to achieve these as it was closely linked to lesson aims. For example, Bart Manny's TV series set an example for the students to prepare a presentation of a geographical region in L1; and like Teacher Danny, the students were expected to demonstrate how to behave as a responsible citizen in L8. In addition to the experts' positive feedback, the strong link between the role models and learning objectives was also highlighted in the rubric results (item 5). Noticeably, there was a similar direct connection in all the lessons; seven out of 14 lessons were awarded above standard regarding this aspect.

## 4.3. Role modeling as a strategy to integrate overarching SRL skills into a lesson

One of the most noteworthy outcomes of this study is the discovery that role modeling strategy functioned like a neuron with synapses attached to various SRL skills. This enabled the teachers to harmonize the commonly known nine target SRL skills within their lessons. The SRL skills integrated into the lesson plans other than role modeling are given below:

a. *Goal setting:* Zimmerman (1998) positions goals in all three phases of self-regulation: forethought (setting goals); performance (carrying out goal-directed actions); and self-reflection (evaluating their progress after). Likewise, in this research, the students were encouraged to set goals at the beginning of the lesson (e.g., in L10, the students were asked to write two things they expected to learn from this lesson), to monitor their performance during the task (e.g., in L1, when planning their presentation like Bart Manny, they identified a place to introduce and determined information to present), and to set new goals after reflecting on their progress at the end of the lesson (e.g., in L11, they decided to implement actions to decrease the damaging impact of fast-food consumption on the environment).

b. *Organizing:* As one of the most important cognitive skills for academic success in the classroom (Weinstein and Mayer, 1986), 'organizing' involves mapping, drawing conclusions, highlighting the key information and summarizing (Pintrich, 1999), all of which were visible in the lesson plans, such as making a drawing to represent the given atomic scientist's atom model in L5, identifying the key characteristics of Nathan Demmy as an entrepreneur in L6, or summarizing their ideas to protect their neighborhood like Greta Thunberg on a poster or Flipgrid presentation in L7.

c. *Seeking information:* As seeking information from electronic sources is deemed important, especially when working alone (Zimmerman,

2008), the students were encouraged to take responsibility for their own learning and practice their 'know-where' skills. In almost all the lessons, to access the information for the given tasks, the students were asked to search online and use online interactive boards (e.g., Padlet), student response systems (e.g., Mentimeter), and mind mapping software (e.g., Mindmeister).

d. *Seeking social assistance:* As one of the leading SRL skills (Zimmerman and Martinez-Pons, 1986), seeking assistance aims to foster students' learning by enhancing their immediate learning (Farajollahi and Moenikia, 2010). In line with this, as seen in Table 5, students were allowed to collaborate in groups, in pairs or as a whole class to learn from each other when emulating the role models in all the lessons.

e. *Self-questioning:* Chin (2006) defines self-questioning as a metacognitive or reflective skill that helps learners adjust their thinking on task. Bearing the importance of this skill in mind, the teachers provided the students with opportunities to question themselves throughout the lessons. Notably, the role models themselves triggered this self-questioning process. For example, in L15, the teacher set himself as a role model in reducing his carbon footprint and was the stimulus for students' self-questioning before making suggestions. In L4, after watching a video on the founder of the country's passion for reading, they used self-questioning to try and identify why they may have lacked a habit of reading.

f. *Self-monitoring:* Pintrich (2004) regards monitoring one's own progress towards goal achievement as one of the main pillars of all the SRL models. Similarly, the teachers in this study allowed the students to monitor their progress throughout the lesson, both individually and in groups. The students were also encouraged to integrate e-tools like Padlet and Jamboard in their monitoring process. Additionally, there was positive feedback given by the experts in this regard such as "The Edpuzzle video helps the students to monitor their progress while answering the questions" (L6); and "The Google Drive activity fosters the students' monitoring skills" (L3).

g. *Time management:* Since planning strategies and timelines to accomplish aims and tasks is an inevitable part of SRL (Zimmerman, 2008; Ambrose et al., 2010), some teachers specified the time limits for the group and pair work activities in the lesson plans, such as in L4 and L10. In L10, the teacher also made an explicit statement in bold that "the students are expected to **manage their time well**." The experts highlighted this skill in particular in their feedback, and made suggestions to some teachers that, in addition to setting the time limit at the beginning of the activity, they could have assigned one student for keeping the time in their group (L14).

h. *Self-reflecting:* Self-reflection is essential for self-regulated learners (Ewijk et al., 2015). In keeping with this tenet, in all the lessons, the students were encouraged to self-reflect on their performance through a multitude of activities, such as completing an exit ticket (L6), creating a Wordwall (L5), answering the question of "What have I learned?" (L8), through using a Google document titled "Evaluate Yourself" (L13), or completing a Quizizz exercise (L14). The focus on self-reflection also appeared in the expert feedback. "The video [on leaders and leadership] and your well-formulated questions encourage the students to do self-reflection" (L2), and "the reflection notebook seems very effective" (L7).

i. *Transferring:* Transfer of learning occurs when learners can apply their knowledge and skills to a new case or situation (Baum et al., 1997). One of the study's more striking outcomes is the discovery that the lesson role models were the starting point for students' transfer of skills. For example, after learning about Greta Thunberg's

environmental efforts for the planet, students adapted this learning to focus on protecting their own neighborhood (L7); in L14, after working on Gregor Mendel's studies and experiments, the students were asked to evaluate modern experimental devices.

Like many studies, this research also demonstrates that technology has a great potential for SRL (McLoughlin and Lee, 2010) and that technology assisted SRL strategies foster students' learning performance (Chang and Chang, 2014; Wang and Zhan, 2020). For example, the students were encouraged to use Google Classroom to set goals, Mindmeister to organize the information, Mentimeter to self-question, and Padlet to monitor their own or peers' progress. To give specific examples of technologies boosting the role modeling strategy, in L5, the students were encouraged to take the roles of the atomic scientists given and act like them in the 'breakout rooms'. In L3, the students elaborated on the characteristics of the founder of their country by posting messages on 'nearpod'. This increased their perspective on the role model. In L1, the students were asked to prepare a video to introduce a place by using 'flipgrid' like the role model given, Bart Manny, in that lesson. This study demonstrates that technology can play a prominent role in the acquisition of target SRL skills.

The experts also underscored the smooth integration of many other SRL skills by means of role modeling. For example, for L13, the expert wrote "Group work improves their seeking help; the 'evaluate yourself activity' contributes to their self-reflective skills. These are very satisfactory." For L14, the positive feedback was given for improving the students' goal setting (*via* Google Docs), transferring (*via* making comparisons between the past and modern experimental tools), social assistance seeking (in group work) and self-reflection skills (*via* an exit card activity). Additionally, the rubric results (item 8) demonstrated that there was cohesive employment of various SRL skills in all the lessons. Noticeably, out of 16 lessons, four were awarded 'standard' and 12, 'above standard', demonstrating the use and value of role modeling in teaching SRL.

## 5. Conclusion

This study showed that teaching SRL learning skills can be integrated at various grade levels with minimal differences in attainability, in various subjects, when teaching various topics, without dramatic changes in daily teaching routine. As in other studies, this research also has its limitations. First, the validity of this study depends on the reliability of the instruments used. Another point is that the data were obtained from a single institution. Lastly, there was no control group in the study. Thus, a control group could be established in future comparative studies. The professional training designed and implemented for in-service K-12 teachers made a meaningful change in the participant teachers' SRL teaching through role modeling strategy. As seen in the data, the teachers acted as agents for the improvement of learners' SRL skills through role modeling. Also, role modeling

functioned as a key to learning-centered lessons, promoting the integration of various other SRL skills into a lesson. Role modeling strategies as part of SRL research should be explored in further studies involving teachers, role models and students from less homogenous national, cultural and language backgrounds to observe the impact on multi-national and multi-cultural learning environments. As role modeling successfully responded to the students' motivational, cognitive, affective, and behavioral needs, the teacher training program in this study can be used as a model and guidance for other institutions aiming to organize programs for their teachers.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

TA: conceptualization, investigation, methodology, project administration, supervision, and writing – review and editing. GA: data curation, investigation, and writing – review and editing. MB: data curation, validation, and writing – review and editing. MK: methodology, validation, writing – original draft preparation, and writing – review and editing. SÖ: writing – review and editing. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

## References

Ambrose, S., Bridges, M., DiPietro, M., Lovett, C. M., and Norman, M. K. (2010). *How learning works: Seven research-based principles for smart teaching*. San Francisco, CA: Jossey-Bass.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prenctice Hall, 23–28.

Bandura, A. (1989). Human Agency in Social Cognitive Theory. *Am. Psychol*. 44, 1175–1184. doi: 10.1037/0003-066X.44.9.1175

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Baum, S., Owen, S., and Oreck, B. (1997). Transferring individual self-regulation processes from arts to academics. *Arts Educ. Policy Rev*. 98, 32–39. doi: 10.1080/10632913.1997.9936393

Baumeister, R. F., and Heatherton, T. F. (1996). Self-regulation failure: an overview. *Psychol. Inq.* 7, 1–15. doi: 10.1207/s15327965pli0701_1

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., and Krathwohl, D. R. (1956). "Taxonomy of educational objectives: the classification of educational goals" in *Handbook 1: Cognitive domain* (New York: David McKay Co Inc.).

Boekaerts, M. (1997). Self-regulated learning: a new concept embraced by researchers, policy makers, educators, teachers, and students. *Learn. Instr.* 7, 161–186. doi: 10.1016/S0959-4752(96)00015-1

Boekaerts, M. (1999). Self-regulated learning: where we are today. *Int. J. Educ. Res.* 31, 445–457. doi: 10.1016/S0883-0355(99)00014-2

Boekaerts, M., Pintrich, P. R., and Zeidner, M. (2000). *Handbook of self-regulation*. San Diego, CA: Academic Press.

Braun, V., and Clarke, V. (2016). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

Butler, D. L. (1998). The strategic content learning approach to promoting self-regulated learning: a report of three studies. *J. Educ. Psychol.* 90, 682–697. doi: 10.1037/0022-0663.90.4.682

Butler, D. L., Lauscher, H. N., Jarvis-Selinger, S., and Beckingham, B. (2004). Collaboration and self-regulation in teachers' professional development. *Teach. Teach. Educ.* 20, 435–455. doi: 10.1016/j.tate.2004.04.003

Butler, D. L., Schnellert, L., and Cartier, S. C. (2013). Layers of self-and Coregulation: teachers' co-regulating learning and practice to Foster students' self-regulated learning through Reading. *Educ. Res. Int.* 2013, 1–19. doi: 10.1155/2013/845694

Cengiz-Istanbullu, B., and Sakiz, G. (2022). Self-regulated learning strategies impact fourth-grade students' positive outcomes in science class. *J. Balt. Sci. Educ.* 21, 192–206. doi: 10.33225/jbse/22.21.192

Chang, C., and Chang, C.-K. (2014). Developing students' listening metacognitive strategies using online videotext self-dictation-generation learning activity. *EuroCall Rev.* 22, 3–19. doi: 10.4995/eurocall.2014.3636

Chen, M., and Wu, X. (2021). Attributing academic success to giftedness and its impact on academic achievement: the mediating role of self-regulated learning and negative learning emotions. *Sch. Psychol. Int.* 42, 170–186. doi: 10.1177/0143034320985889

Chin, C. (2006). Using self-questioning to promote Pupils' process skills thinking. *Sch. Sci. Rev.* 87, 113–119.

Cleary, T. J., and Kitsantas, A. (2017). Motivation and self-regulated learning influences on middle school mathematics achievement. *Sch. Psychol. Rev.* 46, 88–107. doi: 10.1080/02796015.2017.12087607

Corno, L. (2001). "Volitional aspects of self-regulated learning" in *Self-regulated learning and academic achievement: Theoretical perspectives.* eds. B. J. Zimmerman and D. H. Schunk. *2nd* ed (Mahwah, NJ: Erlbaum), 191–225.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (Vol. 7). Prentice Hall Upper Saddle River, NJ.

Dermitzaki, I., and Kallia, E. (2021). "The role of parents and teachers in fostering children's self-regulated learning skills" in *Trends and prospects in metacognition research across the life span* (Cham: Springer), 185–207.

Dignath, C., and Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacogn. Learn.* 3, 231–264. doi: 10.1007/s11409-008-9029-x

Dignath, C., and Büttner, G. (2018). Teachers' direct and indirect promotion of self-regulated learning in primary and secondary school mathematics classes–insights from video-based classroom observations and teacher interviews. *Metacogn. Learn.* 13, 127–157. doi: 10.1007/s11409-018-9181-x

Dignath, C., Büttner, G., and Langfeldt, H. (2008). How can primary school students learn self-regulated learning strategies Most effectively? A meta-analysis on self-regulation training Programmes. *Educ. Res. Rev.* 3, 101–129. doi: 10.1016/j.edurev.2008.02.003

Dignath-van Ewijk, C., Dickhäuser, O., and Büttner, G. (2013). Assessing how teachers enhance self-regulated learning: a multi-perspective approach. *J. Cogn. Educ. Psychol.* 12, 338–358. doi: 10.1891/1945-8959.12.3.338

Ericsson, K. A., and Lehmann, A. C. (1996). Expert and exceptional performance: evidence on maximal adaptations on task constraints. *Annu. Rev. Psychol.* 47, 273–305. doi: 10.1146/annurev.psych.47.1.273

Ertmer, P. A., and Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: comparing critical features from an instructional design perspective. *Perform. Improv. Q.* 6, 50–72. doi: 10.1111/j.1937-8327.1993.tb00605.x

Esparragoza, R. (2021). Students' perceptions of motivation and use of metacognitive self-regulated learning strategies in remote asynchronous elementary Spanish classes (Doctoral dissertation, The University of North Carolina at Charlotte).

Ewijk, C. D. V., Fabriz, S., and Büttner, G. (2015). Fostering self-regulated learning among students by means of an electronic learning diary: a training experiment. *J. Cogn. Educ. Psychol.* 14, 77–97. doi: 10.1891/1945-8959.14.1.77

Farajollahi, M., and Moenikia, M. (2010). The compare of self-regulated learning strategies between computer-based and print-based learning students. *Procedia Soc. Behav. Sci.* 2, 3687–3692. doi: 10.1016/j.sbspro.2010.03.573

Hall, C. W., Spruill, K. L., and Webster, R. E. (2002). Motivational and attitudinal factors in college students with and without learning disabilities. *Learn. Disabil. Q.* 25, 79–86. doi: 10.2307/1511275

Holzer, J., Lüftenegger, M., Korlat, S., Pelikan, E., Salmela-Aro, K., Spiel, C., et al. (2021). Higher education in times of COVID-19: university students' basic need satisfaction, self-regulated learning, and well-being. *Aera Open* 7:233285842110031. doi: 10.1177/23328584211003164

Hong, J. C., Lee, Y. F., and Ye, J. H. (2021). Procrastination predicts online self-regulated learning and online learning ineffectiveness during the coronavirus lockdown. *Personal. Individ. Differ.* 174:110673. doi: 10.1016/j.paid.2021.110673

Horsburgh, J., and Ippolito, K. (2018). A skill to be worked at: using social learning theory to explore the process of learning from role models in clinical settings. *BMC Med. Educ.* 18, 1–8. doi: 10.1186/s12909-018-1251-x

Kaplan, A. (2008). Clarifying metacognition, self-regulation, and self-regulated learning: What's the purpose? *Educ. Psychol. Rev.* 20, 477–484. doi: 10.1007/s10648-008-9087-2

Kar, B. R., Vijay, N., and Mishra, S. (2013). Development of cognitive and affective control networks and decision making. *Prog. Brain Res.* 202, 347–368. doi: 10.1016/B978-0-444-62604-2.00018-6

Karaca, M., and Bektaş, O. (2021). The relationship between perceived role models and self-regulation in science. *Int. J. Educ. Res.* 110:101884. doi: 10.1016/j.ijer.2021.101884

Karlen, Y., Hertel, S., and Hirt, C. (2020). Teachers' professional competences in self-regulated learning: an approach to integrate teachers' competences as self-regulated learners and as agents of self-regulated learning in a holistic manner. *Front. Educ.* 5:159. doi: 10.3389/feduc.2020.00159

Kistner, S., Rakoczy, K., Otto, B., Dignath-van Ewijk, C., Büttner, G., and Klieme, E. (2010). Promotion of self-regulated learning in classrooms: investigating frequency, quality, and consequences for student performance. *Metacogn. Learn.* 5, 157–171. doi: 10.1007/s11409-010-9055-3

Kistner, S., Rakoczy, K., Otto, B., Klieme, E., and Büttner, G. (2015). Teaching learning strategies: the role of instructional context and teacher beliefs. *J. Educ. Res. Online* 7, 176–197. doi: 10.25656/01:11052

Koivuniemi, M., Järvenoja, H., Järvelä, S., and Thomas, V. (2021). An overview of instruments for assessing and supporting elementary school students' self-regulated learning. *Learn.: Res. Practice* 7, 109–146. doi: 10.1080/23735082.2020.1859123

Lave, J. (1991). "Situating learning in communities of practice" in *Perspectives on socially shared cognition.* eds. L. B. Resnick, J. M. Levine and S. D. Teasley (United States: American Psychological Association), 63–82.

Lee, S., Kwon, S., and Ahn, J. (2021). The effect of modeling on self-efficacy and flow state of adolescent athletes through role models. *Front. Psychol.* 12:661557. doi: 10.3389/fpsyg.2021.661557

Lockwood, P., and Kunda, Z. (1999). Increasing the salience of One's best selves can undermine inspiration by outstanding role models. *J. Pers. Soc. Psychol.* 76, 214–228. doi: 10.1037/0022-3514.76.2.214

Lombaerts, K., De Backer, F., Engels, N., Braak, V., and Athanasou, J. (2009). Development of the self-regulated learning teacher belief scale. *Eur. J. Psychol. Educ.* 24, 79–96. doi: 10.1007/BF03173476

Lunenberg, M., and Korthagen, F. A. J. (2003). Teacher educators and student-directed learning. *Teach. Teach. Educ.* 19, 29–44. doi: 10.1016/S0742-051X(02)00092-6

Lunenberg, M., Korthagen, F., and Swennen, A. (2007). The teacher educator as a role model. *Teach. Teach. Educ.* 23, 586–601. doi: 10.1016/j.tate.2006.11.001

McLoughlin, C., and Lee, M. J. (2010). Personalised and self-regulated learning in the web 2.0 era: international exemplar of innovative pedagogy using social software. *Australas. J. Educ. Technol.* 26, 28–43. doi: 10.14742/ajet.1100

Meltzer, L., Katzir-Cohen, T., Miller, L., and Roditi, B. (2001). The impact of effort and strategy use on academic performance: student and teacher perceptions. *Learn. Disabil. Q.* 24, 85–98. doi: 10.2307/1511065

Merino, A., and Aucock, M. (2014). The role-modeling of self-regulated learning strategies and skills through enrichment tutorials. In Transformative, Innovative and Engaging. Proceedings of the 23rd Annual Teaching Learning Forum, 30–31.

Miller, S., Heafner, T., and Massey, D. (2009). High-school teachers' attempts to promote self-regulated learning: I may learn from you, yet how do I do it? *Urban Rev.: Issues and Ideas in Public Educ.* 41, 121–140. doi: 10.1007/s11256-008-0100-3

Moely, B. E., Hart, S. S., Leal, L., Santulli, K. A., Rao, N., Johnson, T., et al. (1992). The teacher's role in facilitating memory and study strategy development in the elementary school classroom. *Child Dev.* 63, 653–672. doi: 10.2307/1131353

Mooji, T., Steffens, K., and Andrade, M. S. (2014). Self-regulated and technology-enhanced learning: a European perspective. *European Educ. Res. J.* 13, 519–528. doi: 10.2304/eerj.2014.13.5.519

Morgenroth, T., Ryan, M. K., and Peters, K. (2015). The motivational theory of role modeling: how role models influence role aspirants' goals. *Rev. Gen. Psychol.* 19, 465–483. doi: 10.1037/gpr0000059

Morrison, M., Haley, E., Sheehan, K., and Taylor, R. (2002). *Using qualitative research in advertising: Strategies, Techniques and Applications*, New York. SAGE Publishing.

Otara, A., Uworwabayeho, A., Nzabalirwa, W., and Kayisenga, B. (2019). From ambition to practice: an analysis of teachers' attitude toward learner centered pedagogy in public primary schools in Rwanda. *SAGE Open* 9, 215824401882346–215824401882311. doi: 10.1177/2158244018823467

Palincsar, A. S., Magnussen, S. J., Marano, N., Ford, D., and Brown, N. (1998). Designing a community of practice: principles and practices of the GIsML community. *Teach. Teach. Educ.* 14, 5–19. doi: 10.1016/S0742-051X(97)00057-7

Panadero, E. (2017). A review of self-regulated learning: six models and four directions for research. *Front. Psychol.* 8:422. doi: 10.3389/fpsyg.2017.00422

Panadero, E., and Alonso-Tapia, J. (2014). ¿Cómo autorregulan nuestros alumnos? Modelo de Zimmerman sobre estrategias de aprendizaje. *Anales de Psicología / Annals of Psychology* 30, 450–462. doi: 10.6018/analesps.30.2.167221

Perry, N. E. (1998). Young Children's self-regulated learning and contexts that support it. *J. Educ. Psychol.* 90, 715–729. doi: 10.1037/0022-0663.90.4.715

Perry, N. E. (2013). Understanding classroom processes that support Children's self-regulation of learning [monograph]. *British Journal of Educational Psychology, Monograph Series II: Psychological Aspects of Educ. Current Trends* 10, 45–68.

Perry, N. E., Hutchinson, L., and Thauberger, C. (2008). Talking about teaching self-regulated learning: scaffolding student teachers' development and use of practices that promote self-regulated learning. *Int. J. Educ. Res.* 47, 97–108. doi: 10.1016/j.ijer.2007.11.010

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *Int. J. Educ. Res.* 31, 459–470. doi: 10.1016/S0883-0355(99)00015-4

Pintrich, P. R. (2000). "The role of goal orientation in self-regulated learning" in *Handbook of self-regulation*. eds. M. Boekaerts, P. Pintrich and M. Zeidner (San Diego, CA: Academic Press), 451–502.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educ. Psychol. Rev.* 16, 385–407. doi: 10.1007/s10648-004-0006-x

Pintrich, P. R., Smith, D. A., Garcia, T., and McKeachie, W. J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educ. Psychol. Meas.* 53, 801–813. doi: 10.1177/0013164493053003024

Prince, J. K., and Felder, R. M. (2006). Inductive teaching and learning methods: definitions, comparisons and research bases. *J. Eng. Educ.* 95, 123–138. doi: 10.1002/j.2168-9830.2006.tb00884.x

Saldana, J., and Omasta, M. (2017). *Qualitative research: Analyzing life*. New York: SAGE Publications..

Schaw, G., Crippen, K. J., and Hartley, K. (2006). Promoting self-regulation in science education: metacognition as part of a broader perspective on learning. *Res. Sci. Educ.* 36, 111–139. doi: 10.1007/s11165-005-3917-8

Schunk, D. H. (1989). "Social cognitive theory and self-regulated learning" in *Self-regulated learning and academic achievement. Springer series in cognitive development*. eds. B. J. Zimmerman and D. H. Schunk (New York, NY: Springer), 83–110.

Schunk, D. H. (1994). "Self-regulation of self-efficacy and attributions in academic settings" in *Self-regulation of learning and performance: Issues and educational applications*. eds. D. H. Schunk and B. J. Zimmerman (NJ: Lawrence Erlbaum Associates, Inc.), 75–99.

Schunk, D. H. (2014). *Learning theories: An educational perspective*. 6th, Pearson Prentice Hall, Upper Saddle River.

Schunk, D. H., and Zimmerman, B. J. (1996). "Modeling and self-efficacy influences on children's development of self-regulation" in *Social motivation: Understanding children's school adjustment*. eds. J. Juvonen and K. R. Wentzel (Cambridge University Press), 154–180.

Shulman, L. S., and Shulman, J. H. (2004). How and what teachers learn: a shifting perspective. *J. Curric. Stud.* 36, 257–271. doi: 10.1080/0022027032000148298

Sitzmann, T., and Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: what we know and where we need to go. *Psychol. Bull.* 137, 421–442. doi: 10.1037/a0022777

Stoeger, H., and Ziegler, A. (2011). "Self-regulatory training through elementary-school students' homework completion" in *Handbook of self-regulation of learning and performance*. eds. B. J. Zimmerman and D. H. Schunk (New York: Routledge), 87–101.

Thomas, V., Peeters, J., De Backer, F., and Lombaerts, K. (2022). Determinants of self-regulated learning practices in elementary education: a multilevel approach. *Educ. Stud.* 48, 126–148. doi: 10.1080/03055698.2020.1745624

Tonks, S. M., and Taboada, A. (2011). "Self-regulatory training through elementary-school students' homework completion" in *Handbook of self-regulation of learning and performance*. eds. B. J. Zimmerman and D. H. Schunk (New York: Routledge), 87–101.

Vermunt, J. D., and Verloop, N. (1999). Congruence and friction between learning and teaching. *Learn. Instr.* 9, 257–280. doi: 10.1016/S0959-4752(98)00028-0

Vrieling-Teunter, E. M. (2012). Promoting self-regulated learning in primary teacher education. Doctoral Thesis. Available at: https://www.ou.nl/documents/40554/111703/Thesis_EmmyVrieling_2012.pdf/61571b8b-d8ae-4cbf-9040-444396d3f814

Wang, W., and Zhan, J. (2020). The relationship between English language learner characteristics and online self-regulation: a structural equation modeling approach. *Sustain. For.* 12:3009. doi: 10.3390/su12073009

Weinstein, C. E., and Mayer, R. E. (1986). "The teaching of learning strategies" in *Handbook of research on teaching*. ed. M. Wittrock (New York: Macmillan), 315–327.

Weinstein, C. E., Palmer, D., and Schulte, A. C. (1987). *Learning and study strategies inventory (LASSI)*. Clearwater, FL: H & H Publishing.

Winne, P. H. (1997). Experimenting to bootstrap self-regulated learning. *J. Educ. Psychol.* 89, 397–410. doi: 10.1037/0022-0663.89.3.397

Winne, P. H., and Hadwin, A. F. (1998). "Studying as self-regulated learning" in *Metacognition in educational theory and practice*. eds. D. J. Hacker, J. Dunlosky and A. Graesser (Hillsdale, NJ: Lawrence Erlbau), 277–304.

Winne, P. H., and Hadwin, A. (2008). "The weave of motivation and self-regulated learning" in *Motivation and self-regulated learning: Theory, research, and applications*. eds. D. H. Schunk and B. J. Zimmerman (New York, NY: Taylor & Francis), 297–314.

Winne, P. H., and Perry, N. E. (2000). "Measuring self-regulated learning" in *Handbook of self-regulation*. eds. M. Boekaerts, P. R. Pintrich and M. Zeidner (San Diego: Academic Press), 531–566.

Woiceshyn, J., and Daellenbach, U. (2018). Evaluating inductive versus deductive research in management studies: Implications for authors, editors, and reviewers. *Qualitative Research in Organizations and Management* 13, 183–195. doi: 10.1108/QROM-06-2017-1538

Wolters, C. A., and Brady, A. C. (2021). College students' time management: a self-regulated learning perspective. *Educ. Psychol. Rev.* 33, 1319–1351. doi: 10.1007/s10648-020-09519-z

Zeidner, M., and Stoeger, H. (2019). Self-regulated learning (SRL): a guide for the perplexed. *High Abil. Stud.* 30, 9–51. doi: 10.1080/13598139.2019.1589369

Zimmerman, B. J. (1986). Development of self-regulated learning: which are the key subprocesses? *Contemp. Educ. Psychol.* 11, 307–313. doi: 10.1016/0361-476X(86)90027-5

Zimmerman, B. J. (1998). "Developing self-fulfilling cycles of academic regulation: an analysis of exemplary instructional models" in *Self- regulated learning: From teaching to self-reflective practice*. eds. D. H. Schunk and B. J. Zimmerman (New York: Guilford Press), 1–19.

Zimmerman, B. J. (2000). "Attaining self-regulation: a social cognitive perspective" in *Handbook of self-regulation*. eds. M. Boekaerts, P. R. Pintrich and M. Zeidner (United States: Academic Press), 13–39.

Zimmerman, B. J. (2001). "Theories of self-regulated learning and academic achievement: an overview and analysis" in *Self-regulated learning and academic achievement: Theoretical perspectives*. eds. B. J. Zimmerman and D. H. Schunk (Mahwah, NJ: Lawrence Erlbaum), 1–37.

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. *American Educ. Res. Association*. 45, 166–183. doi: 10.3102/0002831207312909

Zimmerman, B. J. (2013). From cognitive modeling to self-regulation: a social cognitive career path. *Educ. Psychol.* 48, 135–147. doi: 10.1080/00461520.2013.794676

Zimmerman, B. J., and Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *Am. Educ. Res. J.* 23, 614–628. doi: 10.3102/00028312023004614

Zimmerman, B. J., and Schunk, D. H. (2001). *Self-regulated learning and academic achievement*. Mahwah, NJ: Erlbaum.

# Appendix A

Rubric on role modeling SRL strategy.

| | | None | Below average | Average | Above average |
|---|---|---|---|---|---|
| 1 | Teacher setting a role model from the class. | None | The teacher sets a role model from the class without elaboration. | The teacher sets a role model from the class with elaboration. | The teacher sets a role model from the class with elaboration and makes metacognitive justification of this SRL strategy in the plan. |
| 2 | Teacher setting a role model outside the class. | None | The teacher sets a role model outside the class without elaboration. | The teacher sets a role model outside the class with elaboration. | The teacher sets a role model outside the class with elaboration and makes metacognitive justification of this SRL strategy in the plan. |
| 3 | The students working on a role model. | None | The students are asked to find a role model only. | The students are asked to find a role model and elaborate on the reasons for their role model or the given role model. | The students are asked to find a role model and elaborate on the reasons for their role model or the given role model. The teacher makes metacognitive justification of this SRL strategy in the plan. |
| 4 | Giving feedback on the students' role modeling. | None | There is a weak reference (in the lesson plan) to giving feedback on the students' role modeling | There is an adequate reference (in the lesson plan) to giving feedback on the students' role modeling | There is an adequate reference (in the lesson plan) involving the students into peer feedback on their role modeling. |
| 5 | Making a link between the role model(s) and lesson objective(s). | None | There is a weak link between the role model(s) and lesson objective(s). | There is a strong link between the role model(s) and lesson objective(s). | There is a strong link between the role model(s) and lesson objective(s). The teacher makes an explicit explanation on that link in the plan. |
| 6 | Referring to the students' cognitive development *via* the role model(s). | None | Limited reference to the students' cognitive development *via* the role model(s) | Some reference to the students' cognitive development *via* the role model(s) | Some reference to the students' cognitive development *via* the role model(s), which is openly stated in the lesson plan. |
| 7 | Referring to the students' affective development *via* the role model(s). | None | Limited reference to the students' affective development *via* the role model(s) | Some reference to the students' affective development *via* the role model(s) | Some reference to the students' affective development *via* the role model(s), which is openly stated in the lesson plan. |
| 8 | The harmony between role modeling and other SRL strategies. | None | Role modeling is used as an isolated SRL strategy. | Role modeling is used in harmony with a few other SRL strategies. | Role modeling is used in harmony with many other SRL strategies. |