Art. #2202, 13 pages, https://doi.org/10.15700/saje.v43n3a2202

Guidelines for instructional design of courses for the development of self-regulated learning for teachers

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Self-regulated learning strategies are essential for learning, and to teach learners to use them, teachers must master them. The objective of this study was to identify training priorities for including these strategies in online courses for teachers, and to determine whether opinion influences the use of strategies. The design was non-experimental and cross-sectional, and involved administering the revised *Cuestionario de Evaluación de las Estrategias de Aprendizaje de los Estudiantes Universitarios* (CEVEAPEU questionnaire) to 285 teachers. The results allow us to differentiate between priority weaknesses, lower-priority weaknesses, and strengths in relation to metacognitive strategies (planning, objectives, self-evaluation, self-regulation, and context). To determine this, a frequency analysis was used, followed by a Mann-Whitney *U* (for 2-group variables) and Kruskal-Wallis (for 3 groups) test to determine whether opinion influences the use of strategies. Priority weaknesses were identified in the knowledge of objectives and evaluation criteria (planification); the ability to recognise when an exam has been passed (self-evaluation); modifying initial plans, dedicating more effort to difficult subjects, and learning new study techniques (self-regulation); and taking advantage of study time (context control). We concluded that opinions on self-regulated learning influence the use of strategies. Finally, work should be done on the recognition of the importance of self-regulated learning, time management strategies, self-evaluation techniques, flexibility, and self-control.

Keywords: distance education; learning to learn; metacognition; self-regulated learning; teacher education

Introduction

The literature suggests the need for training in self-regulation-oriented learning strategies since different models of self-regulated learning (SRL) show relationships with subsequent performance and the achievement of educational goals (Panadero, 2017; Vermunt & Donche, 2017). Also, the development of these strategies from an early age is recommended (Montroy, Bowley, Skibbe, McClelland & Morrison, 2016), because the goal of education is favoured (Hoyle & Dent, 2018) and facilitates the implementation of programmes such as life orientation (LO) in South Africa (Prinsloo, 2007). In this way, the focus becomes learner-centered teaching, which enhances learners' engagement and construction of their own knowledge with active learning (Du Plessis, 2020) and self-monitoring (Van Loon, Bayard, Steiner & Roebers, 2021).

SRL improves performance and achievement by planning (Jansen, Van Leeuwen, Janssen, Jak & Kester, 2019) and this planning is enhanced through the development of time management strategies (Colthorpe, Sharifirad, Ainscough, Anderson & Zimbardi, 2018; Fokkens-Bruinsma, Vermue, Deinum & Van Rooij, 2021) and learning monitoring (Schumacher & Ifenthaler, 2018). Learning monitoring is key for SRL and should be implemented through self-assessment techniques together with a formal reflection of the evidence found through self-assessment (Chen & Bonner, 2020).

Additionally, in digital situations, one of the problems in using the internet for learning is the lack of skills and knowledge to find the right resources (Al-Muwallad, 2020), and that reading comprehension performance in digital environments is lower than performance on paper (Støle, Mangen & Schwippert, 2020). For this reason, due to the characteristics of the digital era, these strategies become indispensable since they deal with a greater amount of content and different formats, confirming a closer relationship between the use of these strategies and educational success in new teaching modalities, such as blended or distance learning (Broadbent, 2017; Kizilcec, Pérez-Sanagustín & Maldonado, 2017; Li, Zheng, Lajoie & Wiseman, 2021; Pardo, Han & Ellis, 2017).

However, to receive adequate training in these strategies, teachers must be able to master them and use them in their own learning (Callan & Shim, 2019; Panadero, 2017). Not all teachers have these skills, and although some may know a generic definition of SRL, they are not always able to identify it and promote it among their learners (Callan & Shim, 2019; Mikroyannidis, Connolly, Law, Schmitz, Vieritz, Nussbaumer, Berthold, Ullrich & Dhir, 2014). The acquisition of these strategies is essential for the continuing education of teachers, as it encourages them to work on continuous professional development, according to the findings of Lessing and De Witt (2007). In addition, teachers' perceived usefulness of SRL is a significant predictor of their ability to implement SRL strategies (Yan, 2018), therefore, teacher training should include strategies to increase the teachers' perceptions of self-efficacy (Dignath, 2021).

In order to successfully teach strategies for SRL to their learners, and for a greater relationship between knowledge about cognition and its application in education, the objective of this research was to determine the training needs of teachers in the area of strategies for SRL. This should make it possible to determine the priorities for the design of distance university courses for teachers.

Literature Review

The choice between the different models of SRL to design an intervention depends on the specific circumstances of the target population. Some interventions focus on cognitive aspects, others on metacognitive, and others on motivational aspects.

In the case of online training, programmes aimed at SRL development may have certain advantages over face-to-face interventions, such as with the use of discussion forums (Cerezo, Bernardo, Esteban, Sánchez & Tuero, 2015; Jansen, Van Leeuwen, Janssen, Conijn & Kester, 2020). However, the relationships found between metacognition, time management, effort regulation, and critical thinking are lower in online interventions than in traditional environments (Broadbent, Panadero, Lodge & De Barba, 2020). Therefore, it is important to design virtual courses that facilitate self-regulation. Students with greater academic success recognise that technology facilitates the use of learning strategies (García-Valcárcel & Tejedor Tejedor, 2017).

Seven attributes stand out in these environments for good online course design that promote SRL (Van Laer & Elen, 2017): (1) authenticity, (2) personalised task selection, (3) learner control in task selection, (4) support to guide learners toward goals, (5) the creation of scaffolding in complex tasks to alleviate cognitive load, (6) the possibility of reflection through feedback, and (7) interaction with peers.

One example is the use of personal learning environments (PLE) to organise and link relevant virtual resources (Tur, Marín, Moreno, Gallardo & Urbina, 2016). Another tool focused on cognitive aspects is nStudy, a platform to support online SRL (Winne & Hadwin, 2013). However, this tool has weaknesses such as not providing adaptive scaffolding and performing ex post assessments on metacognition (Azevedo, Taub & Mudrick, 2018).

There are also tools focused on metacognition and motivation, which are closely related to cognitive aspects. An example is the use of educational tools employed for SRL improvement (Pérez, Marín & Tur, 2018). A particularly comprehensive tool is MetaTutor (Azevedo, Johnson, Chauncey & Burkett, 2010), which differentiates between cognitive strategies, planning tasks, and monitoring tasks corresponding to metacognition.

Another tool, technological or not, that is widely used with high efficacy is self-assessment, which is more effective if carried out through scripts or rubrics (Panadero-Calderón & Alonso-Tapia, 2013).

At this point, control over the context should be included as an aspect resulting from metacognition. Similarly, after reviewing the importance of collaborative learning in SRL, the need to use tools that facilitate interaction among learners is highlighted.

Conceptual Framework

SRL is based on the idea that learners take responsibility for their own learning and play an active role in the learning process (Zimmerman, 2002).

Among the main models of SRL, the model of Zimmerman (2002) has a sociocognitive perspective; Winne (1996) approaches it from a metacognitive perspective; and Pintrich (2004) focuses on the role of motivation.

It is important to understand that the models complement each other, and that, as described by Panadero (2017), SRL is more of a conceptual framework, an umbrella that accommodates different variables that affect learning. Each of the paradigms proposed in SRL assumes a limited framework to drive new research findings on the topic and to convey certain tacit characteristics of each paradigm (Winne, 2019).

There are three key types of strategies in SRL (Muijs & Bokhove, 2020).

Firstly, cognitive strategies should be related to deep learning (De la Fuente, López-García, Mariano-Vera, Martínez-Vicente & Zapata, 2017; Núñez, Cerezo, Bernardo, Rosário, Valle, Fernández & Suárez, 2011) such as the repetition writing strategy (Akamatsu, Nakaya & Koizumi, 2019); i.e., students who do not use adequate cognitive learning strategies show a low level of self-regulation (Iwamoto, Hargis, Bordner & Chandler, 2017).

Interventions on SRL raised with a sociocognitive approach, i.e., through group work, have a great impact on self-regulation of learning (Panadero, 2017). Furthermore, it is important to address cognitive strategies to optimise the cognitive face of learners, given the large amount of content to be learned in each subject. An example of an activity to develop these strategies is to write a diary (Nückles, Roelle, Glogger-Frey, Waldeyer & Renkl, 2020).

Secondly, metacognitive strategies, where metacognition is traditionally divided into metacognitive knowledge and skills, knowledge related to process evaluation, and skills related to feedback mechanisms that facilitate action planning and performance evaluation (Veenman, Van Hout-Wolters & Afflerbach, 2006).

When reviewing different proposals and paradigms of metacognitive strategies, three essential components for regulating metacognition were identified (Muijs & Bokhove, 2020): planning or goal setting, the activation of prior knowledge, and the selection of learning strategies and resources. Supervision is necessary for the control of the learning process during its execution. Evaluation is necessary for the assessment of

results and regulatory processes of the learning process.

In addition, within metacognitive strategies, context control should be considered, as research has shown how context and its characteristics affect learning (Torrano Montalvo & González Torres, 2004), such as organising time or creating a quiet study environment.

Metacognitive strategies, supervision and in particular, the perception of self-efficacy, enhance the use of cognitive strategies. Thus, to enhance students' SRL, it is critical to highlight metacognitive strategies and self-efficacy in SRL interventions (Akamatsu et al., 2019).

Thirdly, socioemotional strategies pose the greatest challenges for collaborative and SRL (Koivuniemi, Panadero, Malmberg & Järvelä, 2017). Among the socioemotional strategies oriented to the regulation of motivation are task interest, perceived self-efficacy, and motivational goals (Alonso-Tapia, Panadero Calderón & Díaz Ruiz, 2014).

Likewise, several components of resilience have shown a strong relationship with SRL: tenacity, perceived control of the situation, less frustration, and better decision-making. Self-regulated students are the most persistent and consistent. In addition, resilience is a good strategy in the face of stress and anxiety (De la Fuente et al., 2017).

It is important to consider the relationship between the motivational aspects and the use of cognitive and metacognitive strategies for SRL. The literature reviewed suggests that the perceived usefulness of SRL influences the ability to apply these strategies (Yan, 2018), and that we should, therefore, improve self-efficacy through training that emphasises the usefulness of SRL (Dignath, 2021). However, motivation alone is not enough for SRL training to be sufficient for SRL; rather, training planning must be adequate for the acquisition of SRL strategies (Cerezo, Fernández, Amieiro, Valle, Rosário & Núñez, 2019). Strategy acquisition will be what demonstrates to teachers the usefulness of SRL by increasing their self-efficacy in knowing how to apply SRL.

In this sense, the relationship between the perception that teachers have of the importance and usefulness of SRL and performance of their learners, and how important it is to work on it in teaching, in general and in online teaching, should be known. If this opinion is favourable, it would increase the motivation of teachers to use learning strategies related to self-regulation, and to teach them to their learners.

Methodology

Research Design

The objective with this study was to detect the weaknesses of teachers in terms of learning strategies that allow self-regulation of their learning. To this end, two specific objectives were established: (1) to propose guidelines for teacher training by detecting the weakest aspects regarding metacognitive learning strategies for SRL in active teachers who are currently in training, and (2) to determine out whether the opinion of self-regulation in learning influences the use of metacognitive strategies.

To achieve these objectives, metacognitive strategies related to SRL are measured, so a nonexperimental, cross-sectional design with a descriptive scope was chosen. In order to measure the objectives, a descriptive research design has been chosen in which frequencies are used, given that we are dealing with ordinal data. In this way, the frequencies give us sufficient information to determine which metacognitive strategies are weakest aspects, and thus create course design recommendations based on the results.

In addition, in Objective 2, designed to answer the question posed by Cerezo et al. (2019) on the relationship between opinion and strategy use, opinion is used as an independent variable to measure whether there are differences in strategy use, the dependent variable being their use. This research design was chosen in order to test whether there are significant differences through inferential statistics tests between teachers who have a favourable opinion about the use of SRL in the classroom and teachers who do not have a favourable opinion.

Participants

The study population corresponds to the student body of a master's degree in Educational Technology and Digital Competences, consisting of a total of 900 students. This master's degree was proposed to acquire the digital teaching competences of the Digital Competence Reference Framework of the Spanish National Institute of Technologies for Education and Training (INTEF, 2017).

A total of 285 students, representing 31.66%, participated, of whom 114 were from Spain, 93 from Colombia, and 78 from Ecuador. The sampling used in this research was non-probabilistic because the students participated voluntarily. We considered the sample to consist of voluntary participants for us to ensure that the answers were sincere and were provided at random. This was considered a sufficient sample because it was close to one third of the study population and we worked with a confidence level of 95% and a margin of error of 5%.

Instruments

A part of the CEVEAPEU questionnaire (Gargallo, Suárez-Rodríguez & Pérez-Pérez, 2009), which evaluates learning strategies in university students,

was used. This questionnaire allows a clear distinction between the different SRL-oriented strategies and includes enough items to have high reliability in each dimension independently. Other questionnaires reviewed (Hernández Barrios & Camargo Uribe, 2017b) lacked these characteristics to measure metacognitive aspects, such as the Motivated Strategies for Learning Questionaire (MSLQ), in its Spanish version, *Cuestionario de Estrategias de. Aprendizaje y Motivación II* ([CEAM II] Roces, Tourón & González, 1995); the *Inventario de Procesos de Autorregulación del Aprendizaje* ([IPAA] Bruna, Pérez, Bustos & Nuñez, 2017); and the Self-regulation Strategy Inventory – Self-report (SRSI-SR), in its Spanish version (Hernández Barrios & Camargo Uribe, 2017a).

This questionnaire consists of two main scales. The first scale contains affective, supportive and control strategies (self-management), and differentiates between four sub-scales, the first two aimed at measuring motivational aspects and the last two focused on metacognitive aspects. The second scale contains strategies related to information processing to measure cognitive aspects.

Two of the four subscales that make up the first scale were selected for this study. These subscales are metacognition, which consists of 15 items and has a Cronbach's alpha of 0.0738, and context and interaction control, which consists of 10 items and has a Cronbach's alpha of 0.703.

Metacognition is measured through four types of strategies: knowledge (D1), planning (D2), evaluation (D3), and control and self-regulation (D4). Context control, social interaction, and resource management are measured through two types of strategies: context control (D5), and social interaction skills and peer learning (D6).

To the 25 questions extracted from the CEVEAPEU questionnaire (Gargallo et al., 2009), we added others that allowed us to elicit opinions on the role of self-regulation in learning (D0). All the questions, and their corresponding dimensions (D) are presented in Table 1.

All items have five response options, being ordinal variables, where 1 means totally disagree and 5 means totally agree, making 3 a neutral response. In addition, item 11 ("I only study before exams") is an inverse item, so it is analysed inversely (1 = totally agree and 5 = totally disagree).

Table 1 Questionnaire items and corresponding dimension

Number (No.)	Item	D
1	Self-regulation is important for deep and meaningful learning to occur.	D0
2	Self-regulation is useful as a strategy to improve learning.	
3	High self-regulation of learning is one of the best predictors of academic performance.	
4	Self-regulation is essential in online learning.	
5	Self-regulation is essential in any type of teaching.	
6	I know what my strengths and weaknesses are when I face the learning of the subjects.	D3
7	I know the evaluation criteria to evaluate me in the different subjects.	D1
8	I know what the objectives of the subjects are.	
9	I plan my time to work on the subjects throughout the course.	D2
10	I keep up to date with the study of the topics of the different subjects.	
11	I only study before exams.	
12	I have a personal work and study schedule, apart from the classes.	
13	I realise when I am doing well in academic tasks without waiting for the teacher's grade.	D3
14	When I see that my initial plans do not achieve the expected success in my studies, I change them for other, more adequate ones.	D4
15	If necessary, I adapt my way of working to the demands of different teachers and subjects.	
16	When I finish an exam, I know if I have done well or not.	D3
17	I dedicate more time and effort to difficult subjects.	D4
18	I try to learn new techniques, skills, and procedures to study better and perform better.	
19	If I have done poorly on an exam because I have not studied well, I try to learn from my mistakes and study better next time.	
20	When I have been given a bad grade on a paper, I do my best to find out what was wrong and improve next time.	
21	I work and study in a suitable place (light, temperature, ventilation, noise, necessary materials at hand, etc.).	D5
22	I usually study in a place where I can concentrate on my work.	
23	I make good use of the time I spend studying.	
24	I create a study environment suitable for good performance.	
25	I try to study or do classwork with other classmates.	D6
26	I usually discuss doubts related to class content with classmates.	
27	I choose suitable partners for teamwork.	
28	I get along well with my classmates.	
29	Teamwork stimulates me to keep going forward.	
30	When I don't understand something, I ask a classmate for help.	

Procedure

The questionnaire was created in Google Forms to facilitate the collection of responses. For this purpose, all the items described in Table 1 were included in the form, with Likert-type response scales. Google Forms allows for questionnaires to be shared through a link and compiles all the responses in a spreadsheet, which can be opened with the statistical software, Statistical Package for the Social Sciences (SPSS) version 25.

The link to the questionnaire was shared with students days before the start of the exams to ensure that students who had not studied for a long time could resume studying before being asked about their learning habits.

The data analysis was first approached with the description of frequencies and percentages to be able to establish the formative priorities from the study of terciles, considering priority weakness (PW) when more than one-third of the sample (33.3%) does not reach a positive score, that is, a score of 3 or lower; minor weakness (MW) when more than two-thirds of the sample (66. 6%) do not score at the maximum score, but less than one-third of the sample is at a neutral score; and strength (S) when less than one-third are at a neutral score and less than two-thirds are at scores other than the maximum (5/5). We made this choice because we considered that these percentages gave us adequate and sufficiently differential information to interpret whether a strategy could be considered a PW or not, as with the strengths. This way of categorising helped us to set the guidelines for the design of the SRL courses.

The influence of the interaction was studied separately, considering whether there were significant differences in terms of their preferences, using the Mann-Whitney *U* test.

On the other hand, the creation of groups for the second objective was done by creating balanced groups with a similar number of participants per group, based on the sum of frequencies of each response level. To determine whether there were significant differences between groups, the Mann-Whitney *U* test was used for variables with two similar groups, and the Kruskal-Wallis test for variables with three similar groups. In this case, the Mann-Whitney *U* and Kruskal-Wallis tests were chosen because they were the most appropriate inferential statistics tests to determine whether there were significant differences between groups (two or three groups, respectively) for ordinal data.

Results

Weaknesses in Teacher Self-regulation

To detect weaknesses, frequencies and percentages were analysed for the items extracted from the CEVEAPEU questionnaire. We analysed those related to metacognition, including context control (cf. Table 2), as well as those related to cooperative learning and social interaction (cf. Table 3), since they needed to be interpreted in a concrete way.

Table 2 Frequencies and percentages (parentheses) in metacognitive strategies for SRL

D	No. item	1	2	3	4	5	%3*	%4**
1	7	21(7.4)	48(16.8)	45(15.8)	85(29.8)	86(30.2)	40.0	69.8
	8	0(0)	15(5.3)	58(20.4)	104(36.5)	108(37.9)	25.6	62.1
2	9	7(2.5)	32(11.2)	72(25.3)	98(34.4)	76(26.7)	38.9	73.3
	10	26(9.1)	64(22.5)	85(29.8)	68(23.9)	42(14.7)	61.4	85.3
	11	53(18.6)	71(24.9)	71(24.9)	66(23.2)	24(8.4)	56.5	81.4***
	12	11(3.9)	50(17.5)	69(24.2)	87(30.5)	68(23.9)	45.6	76.1
3	6	0(0)	13(4.6)	51(17.9)	122(42.8)	99(34.7)	22.5	65.3
	13	4(1.4)	16(5.6)	50(17.5)	132(46.3)	83(29.1)	24.6	70.9
	16	2(0.7)	24(8.4)	70(24.6)	135(47.4)	54(18.9)	33.7	81.1
4	14	12(4.2)	47(16.5)	55(19.3)	111(38.9)	60(21.1)	40.0	78.9
	15	17(6.0)	38(13.3)	37(13.0)	111(38.9)	82(28.8)	32.3	71.2
	17	9(3.2)	45(15.8)	54(18.9)	84(29.5)	93(32.6)	37.9	67.4
	18	5(1.8)	34(11.9)	67(23.5)	98(34.4)	81(28.4)	37.2	71.6
	19	1(0.4)	20(7.0)	43(15.1)	92(32.3)	129(45.3)	22.5	54.7
	20	0(0)	7(2.5)	44(15.4)	94(33)	140(49.1)	17.9	50.9
5	21	0(0)	12(4.2)	58(20.4)	112(39.3)	103(36.1)	24.6	63.9
	22	0(0)	11(3.9)	41(14.4)	124(43.5)	109(38.2)	18.2	61.8
	23	2(0.7)	24(8.4)	83(29.1)	113(39.6)	63(22.1)	38.2	77.9
	24	2(0.7)	11(3.9)	58(20.4)	121(42.5)	93(32.6)	24.9	67.4

Note. *Cumulative percentage of scores 1–3. **Cumulative percentage of scores 1–4. ***Inverse item: Cumulative percentage of scores 3–5 and 2–5, respectively.

By considering the categories to which each item belonged, the following results were obtained:

- Planning: all four items turned out to be priority needs
- Knowledge of objectives: the item on "knowledge of evaluation criteria" was a PW, while "knowledge of objectives" was a strength.
- Self-assessment: "identifying strengths and weaknesses" would be a strength, "perception of doing things well" would be an MW, and "knowing if a test has been completed well", a PW.
- Control and self-regulation: "modifying initial plans", "devoting more effort to difficult subjects" and "learning new study techniques" were priority weaknesses; "adapting the way of working according to the subject" an MW, while "learning from exam mistakes" and "learning from coursework mistakes" would be strengths.
- Control of the context: "making the most of study time" was a PW, while "creating a suitable study environment for good performance" was an MW; "studying in suitable places" and "studying in places that allow concentration" would be strengths.

Table 3 Frequencies and percentages (parentheses) in interaction strategies (D6) for SRL

No. item	1	2	3	4	5	%3*	%4**
25	78(27.4)	73(25.6)	68(23.9)	53(18.6)	13(4.6)	76.8	95.4
26	40(14.0)	50(17.5)	77(27.0)	71(24.9)	47(16.5)	58.6	83.5
27	33(11.6)	40(14.0)	84(29.5)	75(26.3)	53(18.6)	55.1	81.4
28	9(3.2)	15(5.3)	75(26.3)	107(37.5)	79(27.7)	34.7	72.3
29	22(7.7)	31(10.9)	81(28.4)	83(29.1)	68(23.9)	47.0	76.1
30	37(13.0)	47(16.5)	58(20.4)	76(26.7)	67(23.5)	49.8	76.5

Note. *Cumulative percentage in scores 1–3. **Cumulative percentage in scores 1–4.

Regarding interaction, all the issues would be priorities. However, the participants' preferences regarding cooperative study should be considered. For this purpose, interaction items 25 to 28 and 30 were analysed by creating two groups with respect to the results of interaction item 29 ("teamwork stimulates me to work harder"): group 1 (G1) with positive answers (4–5) and group 2 (G2) with neutral and negative answers (1–3). Two balanced groups (G1: 151 participants; G2: 134) were obtained and tested for significant differences between the groups with the Mann-Whitney *U* test (cf. Table 4).

Table 4 Mann-Whitney *U* test for significant differences in terms of preference for group work (no. 29)

	25	26	27	28	30
Mann-Whitney *U*	5026	4713	3974	4334	3304
z	-7.55	-7.98	-9.1	-8.74	-10.1
Asymptotic sig. (bilateral)	0.000	0.000	0.000	0.000	0.000

There are significant differences ($p < 0.05$) for all the items of social interaction and learning with peers according to students' preferences. The implications of these and previous results are discussed in the third objective.

The Influence of Teachers' Opinions

For objective 2, we first analysed the frequencies of the five control questions, the results of which are shown in Table 5.

Table 5 Frequencies (percentages) in control questions to determine opinions about SRL

Item	1	2	3	4	5	%3*	%4**
Importance	2(0.7)	20(7.0)	32(11.2)	78(27.4)	153(53.7)	18.9	46.3
Utility	0(0)	1(0.1)	39(13.7)	95(33.3)	150(52.6)	14.0	47.4
Performance relation	13(4.6)	32(11.2)	57(20.0)	95(33.3)	88(30.9)	35.8	69.1
Necessary education (ed.)	15(5.3)	29(10.2)	49(17.2)	85(29.8)	107(37.5)	32.6	62.5
Necessary online ed.	3(1.1)	17(6.0)	46(16.1)	79(27.7)	140(49.1)	23.2	50.9

Note. *Cumulative percentage in scores 1–3. **Cumulative percentage in scores 1–4.

For three of these variables, approximately half of the participants scored the highest: importance (53.7%), usefulness (52.6%), and necessity in online education (49.1%). In these cases, two groups were established to be as balanced as possible in terms of subjects per group (153–132, 150–135, and 140–145, respectively). For the other two variables, three groups were established to be as balanced as possible: relationship with performance (G1: 30.9%, G2: 33.3%, G3: 35.8%; with 88, 95, and 102 participants, respectively) and necessity in any type of education (G1: 37.5%, G2: 29.8%, G3: 32.6%; with 107, 85, and 93 participants, respectively); in each case – G1 showed higher scores and G3 showed worse scores.

Significant differences between groups were determined using the Mann-Whitney *U* test for variables with two groups and the Kruskal-Wallis test for variables with three groups, with two degrees of freedom (cf. Table 6).

All the items show significant differences between the groups created according to the opinions that students held towards SRL.

Table 6 Results of inferential tests to assess for differences between groups according to opinion

			Mann-Whitney *U*		Kruskal-Wallis	
D	No. item	Importance	Utility	Online ed.	Performance	Education
1	7	5662(z = -6.66) (p < .001)	5826(z = -6.44)-(p < .001)	6123(z = -6.03)-(p < .001)	55.7(p < .001)	52.6(p < .001)
	8	5699(z = -6.52)-(p < .001)	5837(z = -6.35)-(p < .001)	5931(z = -6.24)-(p < .001)	65.2(p < .001)	62.6(p < .001)
2	9	7559(z = -3.76)-(p < .001)	6996(z = -4.62)-(p < .001)	7244(z = -4.29)-(p < .001)	22.3(p < .001)	19.1(p < .001)
	10	5208(z = -7.28)-(p < .001)	4993(z = -7.63)-(p < .001)	5470(z = -6.95)-(p < .001)	51.6(p < .001)	58.9(p < .001)
	11	5317(z = -7.15)-(p < .001)	5317(z = -7.15)-(p < .001)	5808(z = -6.45)-(p < .001)	87.0(p < .001)	83.8(p < .001)
	12	5078(z = -7.71)-(p < .001)	5078(z = -7.71)-(p < .001)	6117(z = -6.15)-(p < .001)	57.2(p < .001)	47.3(p < .001)
3	6	5827(z = -6.38)-(p < .001)	5983(z = -6.38)-(p < .001)	6164(z = -6.13)-(p < .001)	66.1(p < .001)	54.7(p < .001)
	13	5918(z = -6.46)-(p < .001)	5673(z = -6.87)-(p < .001)	5886(z = -6.57)-(p < .001)	58.6(p < .001)	49.2(p < .001)
	16	6345(z = -5.80)-(p < .001)	6996(z = -4.83)-(p < .001)	6968(z = -4.90)-(p < .001)	30.7(p < .001)	32.0(p < .001)
4	14	4575(z = -8.30)-(p < .001)	5191(z = -7.41)-(p < .001)	6226(z = -5.88)-(p < .001)	65.8(p <. 001)	59.5(p < .001)
	15	4279(z = -8.79)-(p < .001)	5569(z = -6.87)-(p < .001)	4387(z = -8.67)-(p < .001)	89.1(p < .001)	96.9(p < .001)
	17	5045(z = -7.56)-(p < .001)	5723(z = -6.58)-(p < .001)	4945(z = -7.76)-(p < .001)	79.00(p < .001)	84.3(p < .001)
	18	5521(z = -6.87)-(p < .001)	5868(z = -6.38)-(p < .001)	6209(z = -5.90)-(p < .001)	64.2(p < .001)	53.0(p < .001)
	19	3984(z = -9.45)-(p < .001)	4582(z = -8.56)-(p < .001)	4767(z = -8.30)-(p < .001)	106.9(p < .001)	81.6(p < .001)
	20	4100(z = 9.42)-(p < .001)	4647(z = -8.59)-(p < .001)	6236(z = -6.13)-(p < .001)	69.9(p < .001)	56.6(p < .001)
5	21	7193(z = -4.46)-(p < .001)	6580(z = -5.43)-(p < .001)	6290(z = -5.90)-(p < .001)	22.5(p < .001)	33.9(p < .001)
	22	6878(z = -5.01)-(p < .001)	6629(z = -5.43)-(p < .001)	6254(z = -6.05)-(p < .001)	23.9(p < .001)	29.7(p < .001)
	23	6938(z = -4.80)-(p < .001)	6521(z = -5.46)-(p < .001)	6564(z = -5.43)-(p < .001)	33.9(p < .001)	21.7(p < .001)
	24	6954(z = -4.83)-(p < .001)	6162(z = -6.08)-(p < .001)	6058(z = -6.27)-(p < .001)	27.3(p < .001)	29.8(p < .001)
6	25	8526(z = -2.34)-(p = .020)	8608(z = -2.25)-(p = .025)	8018(z = -3.16)-(p = .002)	14.6(p = .001)	18.4(p < .001)
	26	7645(z = -3.62)-(p < .001)	7785(z = -3.45)-(p = .001)	7592(z = -3.77)-(p < .001)	7.7(p = .022)	21.7(p < .001)
	27	5476(z = -6.85)-(p < .001)	6638(z = -5.16)-(p < .001)	6768(z = -5.00)-(p < .001)	37.9(p < .001)	41.6(p < .001)
	28	6978(z = -4.72)-(p < .001)	7628(z = -3.77)-(p < .001)	6824(z = -5.02)-(p < .001)	22.9(p < .001)	29.5(p < .001)
	29	6633(z = -5.16)-(p < .001)	6434(z = -5.49)-(p < .001)	7249(z = -4.31)-(p < .001)	38.5(p < .001)	40.6(p < .001)
	30	6239(z = -5.70)-(p < .001)	6045(z = -6.02)-(p < .001)	6720(z = -5.05)-(p < .001)	37.9(p < .001)	50.3(p < .001)

Discussion

The results of this work indicate the existence of weaknesses in the metacognitive strategies used by teachers, which reinforces the need for training in this area, and improves their motivation for continuous professional development (Lessing & De Witt, 2007). This learning allows for improved implementation of programmes such as LO in South Africa (Prinsloo, 2007).

The first step for teachers to be effective in teaching SRL in the classroom is to have a clear understanding of what it constitutes and when it should be used (Callan & Shim, 2019). Teaching to learn is achieved when learners can self-regulate their learning, which transforms the acquisition of knowledge and skills into an active and autonomous process in learner-centred teaching (Du Plessis, 2020). This enables the learner to engage in lifelong learning, the goal of education (Hoyle & Dent, 2018). To that end, programmes aimed at promoting self-regulation of learning in higher education are increasing, while the design of these programmes in an online format is also increasing, allowing even greater effectiveness than face-to-face programmes (Cerezo et al., 2015).

Regarding the analysis of the different dimensions of metacognitive strategies (Gargallo et al., 2009), planning showed the greatest weakness. Even though research indicates that planning is one of the strategies that can be acquired earliest from an evolutionary point of view (Muijs & Bokhove, 2020), it is the one that presents priority weaknesses in its four items. As we have seen, performance and achievement is closely related to planning (Jansen et al., 2019), so training should specifically include strategies to improve planning, like monitoring of learning to improve the understanding of the learning process (Schumacher & Ifenthaler, 2018).

In the knowledge of objectives, the main weakness is related to the knowledge of evaluation criteria, which is necessary to perform correct self-assessment of learning. In this sense, the importance of self-assessment as a fundamental step to self-regulate learning has been demonstrated (Chen & Bonner, 2020). Specifically, within the areas of self-assessment that have been measured in this study, only being able to self-assess whether an exam was being performed well turned out to be a PW, while identifying weaknesses and strengths turned out to be strengths. In this sense, and in relation to Chen and Bonner's proposal (2020), it could be understood that in moments of stress, such as when taking an exam, it is more difficult for them to make a formal reflection on the evidence of self-evaluation, so it would be necessary to focus on this point: reflection.

In the case of control in self-regulation, the priority weaknesses were related to adequate time management ("modifying initial plans", "devoting more effort to difficult subjects" and "learning new study techniques"), since after some time has elapsed, it may be difficult for students to modify what was initially planned, just as it may be difficult to plan adequate time for difficult content and for learning new study techniques. Adequately estimating the necessary learning time is a task that greatly influences SRL, as proposed by Colthorpe et al. (2018) and Fokkens-Bruinsma et al. (2021), and should, therefore, be included in SRL training. In this sense, regarding the dimension control of the context, the PW was related to time management ("making the most of study time"), while the dimensions related to space were strengths.

As part of the control of the context, interaction was included, which we decided to measure in terms of one of the items: whether group work stimulates them to work better. On this point, the motivation for this type of organisation was fundamental to know whether it was advisable to include it in SRL training, or whether it should be treated as complementary content for teachers who felt motivated to work in this way. These results made us understand the importance of motivation in SRL as part of the social-emotional strategies, in this case to collaborate, in accordance with Koivuniemi et al. (2017).

Regarding the second objective, related to the application of SRL strategies according to the influence of teachers' opinion, it can be confirmed that the perception of the importance and usefulness of SRL in learning clearly influenced the application of SRL strategies by teachers (Yan, 2018). Therefore, following Dignath's (2021) proposal, SRL training should increase teachers' self-efficacy in order to have a better perception of its usefulness, and this should be done through the teaching of concrete strategies, according to the conclusions of a study conducted by Cerezo et al. (2019).

Guidelines for Instructional Design of Courses for the Development of SRL

According to the results, we propose that the instructional design of courses for the development of SRL should prioritise the following strategies:

- Adequate time management: helping students to create a regular study schedule, which facilitates keeping up with the subjects throughout the course and not studying only before exams (PW-planning). This is in addition to reflection on difficult subjects to plan more study time (PW-control).
- Reflection on learning: helping students reflect on the evaluation criteria (PW-objectives) based on the knowledge of objectives (S-objectives) and errors in assignments and exams (S-control). In this way, and according to the knowledge of their strengths and weaknesses (S-self-assessment), students self-assess whether they are doing things right during the learning process (PW-self-assessment), and practice

will facilitate such self-assessment in exams (MW-self-assessment).

- SRL knowledge acquisition: provides students with cognitive strategies for SRL in different areas (PW-control), so that they can modify initial study plans (PW-control) and adapt to each subject (MW-control).
- Reflection on the context: helps students, based on studying in appropriate places that allow concentration (S-context), to reflect on what distracts them from performing well (MW-context), such as cell phones or open social networks on computers, to help them make the most of their study time (PW-context).
- In the case of group interaction and learning, we can provide facilities for group study, but should not force it, since this factor depends on the study preferences (individual/group) of each learner.
- It is essential that pre-service teachers are aware of studies conducted on the importance of SRL in education, both face-to-face and online, and its relationship with academic performance. In this way we can motivate them to acquire and apply SRL strategies, which will increase their self-efficacy, and with it the motivation to apply SRL with their learners.

Conclusion

The findings of this study reflect the need to adequately plan training courses on SRL for teachers in order to achieve effective results for the application of metacognitive strategies that increase teachers' self-efficacy. This self-efficacy translates into a better perception of teachers towards these strategies, which allows them to apply them in their classes and improve SRL in their learners. The results of the research have made it possible to elaborate a series of guidelines for the design of these courses, which allows us to advance in the knowledge of what SRL training for teachers should be like.

As future lines of research, it is advisable to delve deeper into each of the dimensions of SRL to confirm the findings. The efficacy of interventions based on these guidelines should also be tested to verify the success of each recommendation and to be able to know which are the most effective and which should be modified to achieve improvements.

Acknowledgements

We acknowledge the teachers of the master's programme in educational technology who helped to disseminate the questionnaire among the students. The open access publication has been financed by the Call for Grants for the translation of scientific articles and publication fees in open access journals 2023/2024 of the International University of La Rioja (UNIR).

Notes

i. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all participants included in the study. To this end, the header of the questionnaire informed students that completion of the questionnaire was voluntary and that if the participants completed it, the data would be used for an anonymous study.

iii. DATES: Received: 16 April 2021; Revised: 12 March 2022; Accepted: 8 November 2022; Published: 31 August 2023.

Authors' Contributions

BOR: Conceptualisation, development of methodology, application of formal analysis, and writing of the original draft. ACS: Validation, provision of human resources, and writing (review and editing). All authors reviewed the final manuscript.

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