Article

Empowering Teachers: Self-Regulated Learning Strategies for Sustainable Professional Development in Initial Teacher Education at Higher Education Institutions

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Abstract: Promoting self-regulated learning (SRL) skills among teachers has emerged as a sustainable professional-learning approach, contributing not only to equip teachers with tools for lifelong learning and professional growth but also to the overall quality of the educational system. Recognising teachers as pivotal agents in this endeavour, this study addresses the under-researched area of promoting SRL skills during initial teacher education at higher education institutions. This study examines factors promoting key SRL strategies among 546 Catalan pre-service teachers. Controlling for students' sociodemographic information, multiple regression analyses are used to make inferential judgments and test the separate effects of the independent variables. The findings emphasise the importance of maintaining a proactive attitude that does not preclude them from seeking help when needed, as well as equipping pre-service teachers with the ability to identify the required academic resources and to maintain their engagement and motivation for self-directed learning. Through rigorous analysis, this study not only provides valuable insights into the factors shaping SRL skills but also highlights the broader sustainability narrative within education. Moreover, the study advocates equipping pre-service teachers with the skills to identify necessary academic resources, promoting resource efficiency, and fostering a culture of continuous learning and adaptation.

Keywords: higher education; sustainable professional development; pre-service teachers; self-regulated learning; teacher education; self-assessment strategies; learning strategies

1. Introduction

There is broad consensus that teaching is the most significant factor at the school level influencing student performance [1]. An aspect increasingly linked to high-quality teaching is the professionals' ability to constantly improve their practices, to be able to engage in new courses of action, or to make quick decisions to improve students' learning [2]. However, in order to become an effective professional, teachers need not only to be equipped with the necessary skills but also to be able to learn during their professional development. In other words, teachers should grow into "high-level knowledge workers who continuously advance their own professional knowledge and that of their profession" [3] (p. 11). In this context, there is a compelling need for high-quality continuous professional learning. Consequently, teacher education has emerged as the most direct and effective means of elevating educational quality [1] and fostering the student's learning.

The idea of sustainable self-regulated learning has been proposed as one of the critical skills in supporting ongoing learning beyond the timeframe of a specific course or educational phase: "Self-regulated learning (SRL) provides the foundation for building sustainable knowledge and is therefore important for schools, classrooms, and lifelong learning in general" [4] (p. 1) This concept identifies self-regulated learning as a sustainable practice that addresses current needs while simultaneously preparing students for their future learning requirements [5]. It emphasises a dedication to self-regulated learning

practices that not only meet immediate educational demands but also contribute to the enduring development of students' abilities. Self-regulated learning is also related to the use of active learning methodologies, such as the flipped classroom, problem-based learning, or challenge-based learning, among others.

The topic is even more relevant if we consider the challenges that educators faced during COVID-19 pandemic times and in the period after, which make even more compelling the requirement to investigate effective approaches that facilitate sustainable learning [6]. This article directly tackles this timely and vital concern, concentrating on essential elements like motivation, a proactive mindset, and assessment for learning to foster self-regulation as a key professional trait for teachers. The proposed research question is: What are the factors promoting self-regulated learning key strategies (i.e., learning strategies, self-assessment strategies, and goal setting and planning) among pre-service teachers?

1.1. Self-Regulated Learning: Conceptions and Benefits for Teaching Practices

In recent years, self-regulated learning (SRL) processes have become a key research topic in education [7] and a basic tool for accomplishing meaningful learning, both during initial teacher education and throughout the professional learning [8,9]. Despite the fact that SRL has been characterised by its complex and interdisciplinary nature over the last few decades, to the point where psychology, behavioural studies, and social cognitive theories converge, there are an increasing number of studies that analyse SRL from a more detailed pedagogical perspective. As well as the desire to identify more reliable instruments for assessing SRL [10], there is also a growing academic concern to determine the most appropriate educational practices for developing this competency in higher education [11,12].

As a result of the conceptual complexity inherent in SRL, different definitions of SRL coexist. The most widespread and accepted is the definition proposed by Zimmerman [13], which understands self-regulation, in general, as being self-generated thoughts, feelings, and actions that are systematically guided by personal goals.

The benefits of SRL on student learning are evident, as the systematic reviews by Panadero [14] demonstrate, linking SRL with a long-term effect due to its transferability to the world of work and lifelong learning. Although few doubts remain about the importance of SRL on the academic and professional development of university students, we do not yet know which strategies best enable its development. Therefore, it is imperative that we learn how to better promote SRL in study programmes and subjects.

SRL is even more relevant if we focus on teacher education. Changes to attitudes, mentalities, and ways of exercising the teaching profession start during initial teacher education [15]. Integrating self-regulation into the curriculum offers a better guarantee that this will subsequently be intentionally included in the school setting [16]. Benefits of including it systematically in the teachers' education programmes are multiple [17], because it makes it easier for them to supervise and improve teaching [18] and to control the environment and conditions during the teaching processes [19], and they need to always be effective and expert learners [20]. The teacher that is capable of self-regulation is in a better position to model and develop learning processes based on autonomy, reflection, metacognition, and self-assessment, which are essential for learning how to learn [21].

When the capacity for self-regulation is not acquired during the initial phase of teacher education, it becomes more difficult to promote it in professional-learning phase and to transfer it to students [22]. Simultaneously, the absence of self-regulation poses significant challenges [23] as it directly influences the learning experience and academic performance [24]. Therefore, a comprehensive approach to initial teacher education should prioritise the development of self-regulation skills [25], equipping aspiring educators with the knowledge and tools essential for mastering this crucial competency [26,27].

By integrating self-regulation into teacher-education programs, future educators can enhance their competence in autonomously guiding their learning processes, identifying their educational needs, and fostering self-motivation for continuous professional learning

and improvement [28]. This approach essentially nurtures the concept of lifelong learning, operating on the premise that teachers evolve into more adept professionals through the deliberate practice of self-regulation [29]. In essence, it aims to cultivate a teaching force that is not only proficient in the subject matter but is also inherently skilled in the dynamic and lifelong pursuit of professional development.

In this regard, the objective of this paper is to shed light on the dynamics of these factors and, specifically, to identify factors promoting key self-regulated learning strategies (i.e., learning strategies, self-assessment strategies, and goal setting and planning) among pre-service teachers. It examines the perception that undergraduates studying for a Primary Education bachelor's degree (which provides students with the basic training needed to teach to 6- to 12-year-olds within the context of the Spanish compulsory-education system) have of the components that comprise SRL and the most appropriate and pertinent strategies for its development. Firstly, we undertake an analysis of various explanatory models of self-regulated learning (SRL) to comprehend their influence on the development of different assessment tools for SRL. Our specific focus lies in examining the applicability of one particular assessment instrument to the context of primary education. Additionally, we explore practices that demonstrate a substantial impact on enhancing SRL skills among university students enrolled in teacher-education programmes. These insights provide valuable clues to educators on effective academic planning strategies for fostering self-regulation in their students.

1.2. Self-Regulated Learning Components

The complexity of SRL as a concept is not only the result of its multidisciplinary nature but also due to the elements that comprise it, including metacognitive and motivational aspects and behavioural strategies that endow students with the ability to acquire academic competencies [30].

The models that explain these SRL components are varied and focus on one or another of the components of this construct, resulting in specific configurations and the design of different assessment instruments. Roth, Ogrin, and Schmitz [11] analysed the most frequently used instruments for assessing SRL, and based on the classification drawn up by Winne and Perry [10], they were able to distinguish between instruments based on different comprehensive SRL models. These authors differentiate between component-oriented models and process-oriented models. The first model sees SRL as an attribute or predisposition that students have and includes aspects such as cognitive strategies (design, organisation, etc.), metacognitive elements (monitoring, regulation, etc.), and resource management strategies (organisation of the external context, support, etc.). The components have been analysed in depth by Pintrich [31] and have been the main basis for the design of the vast majority of the SRL assessment instruments, many of which use the self-report approach. For their part, the latter focuses on the coordination, control, and regulation of strategies, understanding SRL as a multiphase and consecutive phenomenon through which students achieve their learning goals. These have been operationalised by various authors, among them, Zimmerman [13], who proposed a model configured by three phases, throughout which students establish goals and plan how to achieve them.

SRL strategies are methods and techniques that students can use to direct and control their own learning processes. This includes the competence to set goals, monitor progress, adjust behaviours, and maintain motivation. They help students become more aware of their learning and to take an active role in their learning, which can lead to better academic outcomes and deeper, longer-lasting learning. The configuration of the different conceptual models has been accompanied by the design of SRL assessment scales and instruments that prioritise different elements. For example, assimilating SRL as a way of learning through metacognition in accordance with Winne and Perry [10], which involves prioritising metacognitive knowledge and monitoring as key elements in SRL training. Nevertheless, based on the perspective that SRL is a process of social and contextual construction of knowledge, one paradigm that stands out is social cognitive theory [32],

which focuses on elements such as self-efficacy [33,34] and "personal agency", as well as the motivational and affective elements of the students [35].

Meanwhile, an analysis of the most explored mechanisms that contribute to the development of SRL reveal strategies focused on the different phases of the SRL, such as planning, monitoring, or control strategies. The inventory of strategies carried out by García, Castellanos, and Andreu [28] point out that students use a large number of basic learning strategies associated with different levels of SRL, and that they deploy them according to different factors. A debate also exists around the role that assessment strategies play in the development of SRL, an idea that Brandmo, Panadero, and Hopfenbeck [7] have analysed in depth, making connections between SRL and various forms of student assessment.

In any case, most of the scientific works that explore SRL are primarily founded on psychology [14] and emphasise the cognitive, motivational, and affective factors of learners. Nevertheless, although studies carried out from a pedagogical perspective are scarce [36,37], it is worth noting its increasing significance and the opening of new lines of research. These studies have focused on detecting the interactions between the different variables involved in SRL, or between these and the strategies that students implement to develop the different components. It is also worth noting that during all these years of studies, very few empirical analyses on the evolution of SRL have actually been carried out [14].

2. Materials and Methods

The purpose of this paper is to identify factors promoting self-regulated learning key strategies (i.e., learning strategies, self-assessment strategies, and goal setting and planning) among pre-service teachers. The research hypotheses are the following: h1. Students' ability to identify resources is linked to a higher use of SRL strategies; h2. Students' learning motivation is associated to the use of SRL strategies; h3. Students' attitudes towards their own learning process determine the use of SRL strategies.

The fieldwork was conducted between January 2021 and June 2022 and entailed administering an online self-report questionnaire, adapted from Turan, Demirel, and Sayek's self-regulated-learning perception scale [38], to a simple random sample of 546 pre-service teachers from three distinct Catalan universities. SPSS 23 was used for statistical analysis. Table 1 provides information about the participants' sociodemographic characteristics.

Table 1. Participants' sociodemographic characteristics (*n* = 546).

Age	M = 20.12 (SD = 2.41)
Gender (%)	
Female	81.6%
Male	17.4%
University year (%)	
First year	33.0%
Second year	40.7%
Third year	19.1%
Fourth year	7.1%
University Access (%)	
Upper secondary education	78.6%
Vocational training	17.3%
Others	4.1%

2.1. Measures

The study considers independent variables related to students' sociodemographic characteristics (i.e., age, gender, university year, and university access) as well as their skills and attitudes (i.e., ability to identify resources, learning motivation, proactive attitudes, and dependence attitudes).

With regard to students' sociodemographic characteristics, gender includes two categories (0 = female; 1 = male); the age variable was recoded into two categories (0 = 19 years of age and under; 1 = 20 years of age and over); the university year includes the usual four years for undergraduate degrees in the Spanish university system (0 = first year; 1 = second year; 2 = third year; 3 = fourth year); and university access includes the two main access routes to higher education (0 = upper secondary education, 1 = vocational training), in addition to a third category (2 = others) that covers less common access paths such as tests for those over 25 years of age, entrance exams for those over 45 years of age, proof of work experience, or access from other higher studies.

Regarding student's skills and attitudes, university students' autonomy is one of the great challenges faced by higher education institutions, since said autonomy is usually linked to the higher academic performance and satisfaction of the students (e.g., [39,40]). The ability of students to identify resources that allow them to advance in their learning is one of the keys to achieving that autonomy. The students' ability to identify resources was measured on an ad hoc five-point Likert-type scale, with four items ranging from "strongly disagree" to 'strongly agree'. Pre-service teachers indicated the extent to which they identify resources, materials or strategies that facilitate their learning. Factor analysis (see Table 2) reveals an acceptable single-factor structure (KMO = 0.740 and a significant Bartlett's test; $p < 0.001$), with factor loadings ranging from 0.696 to 0.803, explaining 56.1% of the total variance. Reliability analysis shows a Cronbach's α value of 0.735.

Table 2. Factor loading and communalities for students in identifying resources (PCA) (*n* = 546).

	Factor Loading
	1
I identify the resources needed during the learning process.	0.772
I clearly identify the objectives that I have to achieve at the end of the learning process.	0.696
I identify the learning materials that will help me learn.	0.803
I search for ways to facilitate learning in new situations.	0.719

The relationship between motivation and academic performance is one of the most studied topics across all educational stages, including higher education. Likewise, learning motivation constitutes one of the basic elements usually associated with SRL [31]. Students were asked to report their own perceived motivation from an ad hoc Likert-type scale of four items ranging from "strongly disagree" to "strongly agree". The compounded measure includes aspects related to the students' initiative to learn according to their interests, the search for possibilities to learn new things, the taking advantage of opportunities that are presented to them to learn new things, or the curiosity to delve further into what they see, listen, or read. PCA revealed an acceptable one-factor structure (KMO = 0.715 and a significant Bartlett's test; $p < 0.001$), with factor loadings ranging from 0.635 to 0.776 (see Table 3), explaining 51.23% of the total variance. Reliability analysis of the final factor showed an acceptable Cronbach's α value of 0.685.

Table 3. Factor loading and communalities for students' learning motivation (PCA) (*n* = 546).

	Factor Loading
	1
I take action to learn according to my interests.	0.635
I search for possibilities to learn new things.	0.776
I take every opportunity to learn new things.	0.720
I am curious about the causes of things I see, hear, or read.	0.724

An additional ad hoc Likert-type scale was developed to collect information about the level of agreement, with ten items representing students' attitudes towards their own learning process. Six items represented proactive attitudes: the effort by students to eliminate difficulties encountered in the learning process; continuous improvement in their problem-solving strategies; improvement in their weak points in the learning process; selecting the most appropriate learning method to achieve their learning objectives; assessing their mistakes and learning from them during the learning process; coping with the problems they encounter when they need to start studying. The last four items referred to the dependence attitude (i.e., expecting other people to tell them what to do in order to learn; expecting others to provide them with the important knowledge they must learn; expecting other people to solve their problems when they have significant difficulties in resolving a learning issue; and expecting someone else to teach them how to study). Factor analysis (see Table 4) showed a two-factor structure (KMO = 0.782 and a significant Bartlett test; $p < 0.001$) that accounts for 46.85% of the total variance explained in proactive (28.79%) and in dependence attitudes (18.06%). Respectively, the rotated factor solution (Varimax with Kaiser normalisation) provided factor loadings ranging from 0.613 to 0.720 and from 0.585 to 0.747. Both compounded factors showed Cronbach's α values of 0.761 and 0.649.

Table 4. Factor loading and communalities for students' attitudes towards their own learning process (PCA, Varimax -rotated solution) (n = 546).

	Factor Loading	
	1	**2**
Factor 1: Dependence attitudes		
I wait for other people to tell me what to do in order to learn.	0.052	**0.747**
I wait for other people to provide me with the important knowledge that I have to learn.	0.003	**0.731**
When faced with difficulties in solving a problem, I prefer other people to solve it.	−0.089	**0.585**
I prefer to wait for someone to instruct me as to how to study.	−0.184	**0.692**
Factor 2: Proactive attitudes		
I strive to eliminate any difficulties I face during the learning process.	**0.709**	−0.091
I continuously improve my problem-solving methods.	**0.718**	−0.059
I strive to improve my weaknesses in learning.	**0.720**	−0.046
I choose the most appropriate learning approach to reach my goal.	**0.613**	−0.032
I evaluate my mistakes during the learning process and learn from them.	**0.642**	0.007
I face problems in identifying how I should start to study.	**0.617**	−0.093

The dependent variables are learning strategies, self-assessment strategies, and goal setting and planning. Pre-service teachers were asked to provide information on the strategies and practices they use to improve their learning through a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree". The variable "learning strategies", linked to how students think about learning, is made up of four items (see Table 5). The variable "self-assessment strategies", related to students' reflection on their performance, progress, and achievements, is made up of five items; and, finally, the variable "goal setting and planning" includes five items related to the planning and management of the resources and strategies necessary to achieve the objectives, the learning process itself, prioritisation of learning objectives, time management to learn in the most efficient way possible, and the efficient use of learning resources. Factor analysis (see Table 5) showed a three-factor structure (KMO = 0.877 and a significant Bartlett test; $p < 0.001$), which accounts for 54.82% of the total variance explained in learning strategies (8.46%), in self-assessment strategies (10.69%), and in goal setting and planning (35.67%). Respectively, the rotated factor solution (Varimax with Kaiser normalisation) provided factor loadings ranging from

0.529 to 0.775, from 0.553 to 0.742 and from 0.466 to 0.831. The three compounded factors showed a Cronbach's α value of 0.724, 0.734 and 0.819, respectively.

Table 5. Factor loading and communalities for students' SRL strategies (PCA, Varimax-rotated solution) (*n* = 546).

	Factor Loading		
	1	**2**	**3**
Factor 1: Goal setting and planning strategies			
I make a plan to utilise resources and strategies in order to reach my goal.	**0.795**	0.200	0.116
I make a plan as to how I will carry out the learning process.	**0.831**	0.188	0.078
I prioritise my goals.	**0.466**	0.272	0.100
I manage my time in order to learn as efficiently as possible.	**0.740**	0.076	0.248
I make a plan to utilise learning resources efficiently.	**0.754**	0.117	0.260
Factor 2: Self-assessment strategies			
After any learning assignment, I assess whether I learned the material completely.	0.096	**0.553**	0.273
I assess whether or not my goals are accomplished.	0.160	**0.666**	0.197
After accomplishing my objective(s), I identify new goals to achieve.	0.295	**0.614**	0.165
I evaluate my learning approaches to see if they really help me learn.	0.141	**0.654**	0.290
I objectively judge my work during the learning process.	0.121	**0.742**	−0.038
Factor 3: Learning strategies			
I experiment with new learning strategies until I learn the material completely.	0.191	0.336	**0.529**
I use different learning strategies for the acquired knowledge to be sustainable.	0.140	0.210	**0.775**
I search for new strategies if those used in implementing my plan are inadequate.	0.146	0.070	**0.665**
I use different learning strategies for the knowledge I acquire to be meaningful.	0.200	0.184	**0.756**

2.2. Data Analysis

To achieve the research objective, first, a univariate and bivariate descriptive analysis of the data was conducted, employing the corresponding measures of association and significance tests (see Table 6).

Table 6. Means, standard deviations, min. and max., and correlations between observed variables (*n* = 546).

	M	**SD**	**Min–Max**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
Learning strategies (1)	3.69	0.59	2.00–5.00	-										
Self-assessment strategies (2)	3.54	0.56	1.60–5.00	0.543 ***	-									
Goal setting and planning (3)	3.76	0.66	1.20–5.00	0.475 ***	0.483 ***	-								
Learning motivation (4)	4.21	0.46	1.75–5.00	0.312 ***	0.339 ***	0.342 ***	-							
Identifying resources (5)	3.78	0.55	1.00–5.00	0.490 ***	0.479 ***	0.502 ***	0.369 ***	-						
Proactive attitudes (6)	3.96	0.45	2.00–5.00	0.530 ***	0.640 ***	0.460 ***	0.401 ***	0.516 ***	-					
Dependence attitudes (7)	2.42	0.65	1.00–4.75	−0.180 *	−0.056	−0.108 *	−0.197 ***	−0.128 ***	−0.138 ***	-				

Table 6. *Cont.*

	M	SD	Min–Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Gender (8)	0.17	0.40	1.00–2.00	−0.053	0.021	−0.079	−0.064	−0.010	−0.072	0.159 ***	-			
Age (9)	0.49	0.50	1.00–2.00	0.007	−0.067	−0.031	−0.027	0.091 *	0.005	−0.061	0.029	-		
University access path (10)	0.26	0.52	1.00–3.00	0.000	0.011	−0.058	0.063	0.013	0.011	0.017	0.059	0.464 ***	-	
University year (11)	1.00	0.89	1.00–4.00	0.011	−0.094 *	0.030	−0.045	0.043	0.047	−0.078	−0.083	0.592 ***	0.100 *	-

Note. * $p < 0.05$; *** $p < 0.001$.

Next, three multiple regression models were developed, enabling the independent effects to be verified through statistical control between the criterion variables used and the three practices or strategies of self-regulated learning (i.e., learning strategies, self-assessment strategies, goal setting and planning) (see Table 7). Multiple regression modelling, widely adopted in educational studies (e.g., [41,42]), is a particularly well-suited method for studying the relationships between our independent and dependent variables and for quantifying the corresponding partial and independent effects. The results reported in Table 7 follow the usual nomenclature for this type of analysis [43].

Table 7. Multiple-regression models for key self-regulated learning strategies.

	Learning Strategies (1)			Self-Assessment Strategies (2)			Goal Setting and Planning Strategies (3)		
	B (S.E)	Beta	t	B (S.E)	Beta	t	B (S.E)	Beta	t
Constant	0.413 (0.264)	-	1.566	−0.058 (0.225)	-	−0.259	0.163 (0.299)	-	0.544
Age									
19 years or less	-	-	-	-	-	-	-	-	-
20 years or more	−0.021 (0.063)	−0.017	−0.326	−0.053 (0.054)	−0.048	−0.998	−0.098 (0.071)	−0.075	−1.377
Gender									
Female	-	-	-	-	-	-	-	-	-
Male	0.012 (0.055)	0.008	0.226	0.0085 (0.046)	0.059	1.823 *	−0.047 (0.062)	−0.028	−0.764
University Year									
First	-	-	-	-	-	-	-	-	-
Second	−0.024 (0.051)	−0.020	−0.480	−0.084 (0.043)	−0.075	−1.942 *	0.054 (0.058)	0.041	0.942
Third	−0.021 (0.076)	−0.014	−0.270	−0.137 (0.065)	−0.097	−2.113 **	0.090 (0.086)	0.053	1.039
Fourth	−0.006 (0.098)	−0.002	−0.057	−0.150 (0.083)	−0.069	−1.806 *	0.120 (0.111)	0.046	1.084
University access									
Upper secondary education	-	-	-	-	-	-	-	-	-
Vocational training	0.019 (0.065)	0.012	0.293	0.065 (0.055)	0.045	1.188	−0.032 (0.073)	−0.019	−0.442
Other	−0.045 (0.110)	−0.015	−0.409	0.001 (0.094)	0.000	0.008	−0.150 (0.125)	−0.150	−1.203
Learning Motivation	0.078 (0.051)	0.062	1.546	0.071 (0.043)	0.060	1.653 *	0.178 (0.057)	0.125	3.090 ***
Identifying resources	0.304 (0.045)	0.283	6.712 ***	0.201 (0.039)	0.199	5.203 ***	0.414 (0.051)	0.346	8.060 ***
Proactive attitudes	0.466 (0.056)	0.357	8.397 ***	0.645 (0.047)	0.526	13.660 ***	0.332 (0.063)	0.228	5.281 ***
Dependence attitudes	−0.014 (0.033)	−0.016	−0.425	0.024 (0.028)	0.029	0.873	−0.004 (0.037)	−0.004	−0.120
Model summary R² (adjusted R²) F for the model sample size	0.351 (0.338) 26.217 *** 546			0.468 (0.457) 42.621 *** 546			0.330 (0.317) 23.911 *** 546		

Note. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.001$.

The regression coefficients (B), standard errors (SE), the significance *t*-test, and its corresponding standardised version (Beta) were calculated. The F test and the R^2 test were used to determine the significance and the overall fit of the three multiple-regression models. Categorical variables used as predictors in the three regression models were recoded into k-1 dummy variables (indicator variables), taking on the value 0 for one group and 1 for the other. The remaining category acted as a reference category (i.e., 19 years or less, female, first university year, and upper secondary education, respectively). No violation of the main assumptions was observed in the creation of the regression models.

3. Results

As can be seen in Table 6, self-regulation strategies associated with goal setting and planning (e.g., planning to utilise resources and strategies to reach my goals, prioritising my goals, or managing my time to learn as efficiently as possible) are, slightly, the most developed among pre-service teachers (m = 3.76, sd = 0.66). In contrast, although SRL practices related to self-assessment strategies (e.g., checking content assimilation after a learning activity; assessing whether the objectives are met; or assessing whether the way of learning has contributed to better learning) are highly valued, they seem to be the least used among students (m = 3.54, sd = 0.56).

Also, it can be observed that the teacher-education students analysed are highly motivated to learn (m = 4.21, sd = 0.46) and have a high perception of their ability to identify resources, materials, and strategies that facilitate their learning (m = 3.78, sd = 0.55).

Finally, if we look at the attitudes of pre-service teachers, the perception is that they show a more proactive attitude (e.g., effort to eliminate difficulties encountered in the learning process; continuous improvement in their problem-solving strategies; or coping with the problems they encounter when they need to start studying), with m = 3.96 (sd = 0.45), and not so much one of dependence (e.g., expecting other people to tell them what to do in order to learn; expecting others to provide them with the important knowledge they must learn; expecting other people to solve their problems when they have significant difficulties in resolving a learning issue), with m = 2.42 (sd = 0.65).

The correlation between the three types of SRL strategies is moderate, although, as expected, it was slightly higher between learning and evaluation strategies (r = 0.543, $p < 0.001$).

Regarding explanatory variables, the correlations between these variables and the three SRL strategies or practices analysed are quite uneven, with r values ranging from 0.640 ($p < 0.001$) to −0.056 ($p > 0.01$). Of particular note is the low correlation between dependence attitudes and learning strategies (r = −0.180, $p < 0.05$) and goal setting and planning (r = −0.108, $p < 0.05$), as well as the non-significant correlation with the assessment strategies. In any case, as is to be expected, a greater attitude of dependence implies the lower use of practices associated with SRL, as well as less motivation towards learning and less proactive attitudes. In contrast, the proactive attitudes of pre-service teachers show the strongest relationships with SRL practices, with the relationship between these proactive attitudes and assessment strategies being especially high (r = 0.640, $p < 0.001$).

Student motivation and their ability to identify resources also show moderate correlations with SRL strategies, although it is the ability to identify learning resources that shows a more consistent relationship, with r values ranging from 0.502 ($p < 0.001$) to 0.479 ($p < 0.001$).

Finally, in terms of the sociodemographic variables, although the relationships were very weak and non-significant in general, a negative and significant correlation was found between the university year and the use of assessment strategies (r = −0.094, $p < 0.05$) which shows that university students use fewer assessment strategies as they progress in their education.

Overcoming the limitations of the bivariate analyses, Table 7 presents the three regression models developed and tested. These regression models help to explain how the changes in each of the predictor variables are related to the different types of SRL practices and strategies analysed in this study (i.e., learning strategies, self-assessment strategies, and goal setting and planning strategies). Thus, we will begin by discussing the effect of the sociodemographic characteristics (i.e., gender and age); we will continue with students' university year and university access, and lastly, we will be focusing on students' capacity for identifying resources and students' learning motivation and attitudes (i.e., proactive and dependence).

The final regression models are statistically significant and show an acceptable global adjustment: (1) learning strategies ($F_{(11, 533)} = 26.217$, $p < 0.001$), with an R^2 of 0.351;

(2) self-assessment strategies ($F(11, 533) = 42.621$, $p < 0.001$), with an R^2 of 0.468; (3) goal setting and planning strategies ($F(11, 533) = 23.911$, $p < 0.001$), with an R^2 of 0.330.

In coherence with the bivariate relationships discussed, the regression models did not reveal any significant relationship between the sociodemographic variables (i.e., age and gender), university year, university access, and two of the SRL strategies considered: learning strategies and goal setting and planning. Additionally, complementing what the bivariate analysis suggested, once the effect of other variables is controlled, we can see how male students (Beta = 0.059, $p < 0.1$) from the first year use self-assessment strategies for SRL slightly more than other colleagues from the second year (Beta = -0.075, $p < 0.1$), third year (Beta = -0.097, $p < 0.05$), and fourth year (Beta = -0.069, $p < 0.1$).

The most consistent effects of the three models analysed are related to the non-sociodemographic variables. Thus, self-assessment strategies (Beta = 0.060, $p < 0.1$) and goal setting and planning practices (Beta = 0.125, $p < 0.001$) are slightly higher among those pre-service teachers more motivated to learn. On the other hand, although the bivariate analyses showed a positive relationship between learning motivation and the use of learning strategies, this relationship becomes non-significant in the multivariate analysis. Complementarily, primary-teacher-education students' capacity for identifying resources (e.g., identifying the resources needed during the learning process; identifying the learning materials that will help them to learn; searching for ways to facilitate learning in new situations) is clearly contributing to a higher use of learning strategies (Beta = 0.238, $p < 0.000$), self-assessment strategies (Beta = 0.199, $p < 0.000$), and goal setting and planning practices (Beta = 0.346, $p < 0.000$).

Removing these effects, students' attitudes appear, once again, to be related to pre-service teachers' use of SRL practices and strategies. Higher levels of reported proactive attitudes among students have the more consistent impact on three SRL practices analysed, with Beta values ranging from 0.526 ($p < 0.000$) to 0.228 ($p < 0.000$). However, contrary to what was suggested by the bivariate analyses, the results showed no significant relationship between students' dependence attitudes and any of the SRL strategies analysed.

4. Discussion

The practices, strategies, and factors that promote and explain SRL are diverse and vary depending on, among other things, the SRL model we choose (e.g., [14]), the educational stage in question, and the learning modality used (i.e., f2f, online, blended learning). In this study we have examined pre-service teachers' self-regulated learning strategies, particularly, three of the more common and important strategies: learning strategies, assessment strategies, and goal setting and planning strategies.

Promoting SRL skills, through active teaching methods, is a key factor for improving education quality and sustainability, since these skills allow students to perform better and increase their wellbeing [44,45]. This also links to sustainable development, enabling students to acquire skills to make informed decisions for the benefit of themselves and others, now and in the future, and also to put those decisions into practice [46]. The factors that promote SRL skills are varied, but various studies highlight teachers, and the teaching methods they use, as one of the key elements (e.g., [47–49]). Beyond their teaching experience and the teaching strategies used (e.g., [50]), teachers need to have previously developed these SRL skills, either in their initial education or during their professional development as in-service teachers and to become reflective practitioners (e.g., [51,52]). However, as we have discussed, despite the importance of promoting SRL skills in initial teacher education, it is an under-researched area.

The results of this study show that, in general, sociodemographics, university year, and university access information do not provide an adequate explanation for the use of SRL practices and strategies. The most important factors to consider are motivation towards learning and, mainly, the ability of students to find resources, as well as their proactive attitude. Moreover, in contrast to what previous studies show, a lack of self-directedness,

help-seeking, or pre-service teachers' dependence are not significant factors determining the use of any of the three key SRL strategies analysed [53,54].

Specifically, regarding learning strategies, as one of the key components of any SRL model [14,55], our findings suggest that the development of proactive attitudes by students as well as their ability to search for resources, indicators of self-efficacy, are directly associated with a higher use of different learning strategies that lead to more effective and meaningful learning processes, as well as a better internalisation of knowledge. These findings are consistent with previous studies indicating the relationship established not only between self-efficacy and the use of learning strategies but also the impact of these two constructs with SRL [56,57]. Moreover, there are several studies that highlight the relationship established between the learners' active role, active thinking, and self-regulated learning [58]. In fact, Zimmerman [59] describes the self-regulated learner as proactive in their efforts to learn and be aware of their strengths and weaknesses. This implies that students should be prepared by acquiring basic skills consistent with sustainability and that will enable them to make appropriate decisions during their personal and professional life, especially if we want to train professionals capable of meeting current and future challenges [60].

Formative assessment strategies, in any of their modalities (i.e., tutor assessment, peer-assessment, or self-assessment), are directly linked to SRL processes (e.g., [61,62]). In this study we have focused on self-assessment as one of the principal regulatory strategies for learning [63,64]. Contrary to what would be expected and what most studies indicate (e.g., [65,66]), the use of self-assessment strategies decreases as they advance in their education, being higher among novice learners than among more experienced students.

On the other hand, consistent with previous studies, the bivariate analyses show the reciprocal relationship between the use of self-assessment strategies and a higher perception of learning motivation, proactive attitudes, and the capacity for identifying resources [67]. As in the case of learning strategies, the proactive attitudes of students are clearly the most important factor explaining the use of self-assessment strategies, demonstrating again the importance of engaging students in their own learning process [68,69].

Finally, regarding goal setting and planning strategies as a key metacognitive component of the initial or preparatory phase of some of the main SRL models, our results not only indicate that these are the strategies most developed by pre-service teachers, but they also confirm the main theoretical frameworks and studies [70]. Thus, for example, greater learning motivation (e.g., taking advantage of opportunities to learn new things or the curiosity to delve further into what they see, hear, or read) implies a greater use of these types of strategies [71]. Although SRL is usually associated with people with active behaviour in their learning (e.g., [72]), on this occasion, unlike the two previous types of strategies (i.e., learning strategies and self-assessment strategies), proactive attitudes are not the most determining factor in the use of goal setting and planning strategies. Instead, as might be expected, the capacity of pre-service teachers to identify resources is more of a determining factor explaining the use of goal setting and planning strategies. In fact, it is common for the identification and allocation of resources to be directly linked to this type of strategy (e.g., [73]).

In summary, our findings regarding pre-service teachers' use of SRL strategies reinforce the clear influence of considered factors (i.e., learning motivation, capacity for identifying resources, and proactive attitudes), thus showing how complex the SRL processes are. However, contrary to prior studies, being in higher university years seems to be detrimental to the use of self-assessment strategies. Likewise, while there is a body of growing research findings indicating the key role of help-seeking (as a positive reflection of the variable that, in this study, has been defined as dependence attitude) in learning self-regulatory processes, our results do not indicate a significant influence over the three types of SRL strategies analysed.

However, the findings of this study should be interpreted with caution. First of all, it should be borne in mind that the data collected comes from a non-representative sample of

pre-service teachers from three of the largest education faculties of the Catalan University System. Thus, the findings should be treated with caution and should be viewed as an initial exploration of factors affecting pre-service teachers' use of SRL strategies. The use of much more specific measures that consider specific personal and learning programme factors is necessary in order to conduct a more complex and in-depth analysis of SRL strategies used among pre-service teachers. Complementarily, a mixed approach using questionnaires and interviews would offer us a better understanding of SRL among pre-service teachers [74]. Qualitative data could help corroborate and shed light on some of our results, such as to what degree the apparent decrease in the use of self-assessment strategies is real or is only due to a more critical perception as a result of the personal and intellectual maturity of pre-service teachers, the apparent disassociation between help-seeking behaviours and the use of SRL strategies, the perception of pre-service teachers regarding the impact that these SRL will have on their subsequent professional activity or, even, as other similar studies have indicated, the influence of university academics on the use of SRL strategies among pre-service teachers (e.g., [50]). Additionally, the design of longitudinal research studies, as well as the use of non-self-reported data, could provide a deeper understanding of the use of SRL for a more sustainable professional development.

In conclusion, the study has several implications for teaching practices, the promotion of active teaching methods in higher education, and education policymakers when we consider the current need for any educational institution to ensure that teachers are engaged in self-regulated learning (i.e., setting goals and developing plans, selecting appropriate strategies, or self-assessment of their own professional development, among others), which would therefore increase teaching effectiveness. The results focus attention not only on the importance of equipping pre-service teachers with the abilities to plan their learning process and identify the required resources but also in keeping them engaged and motivated for their own learning, as well as to develop a proactive attitude that does not detract from seeking help when needed, as this is also considered an important SRL strategy.

In initial teacher education, SRL not only has an impact on teacher education but also contributes to sustainable professional development in education. The inclusion of strategies that promote, among other things, self-assessment, planning, motivation, or reflection with regard to the training processes in which one participates can enhance SRL. However, it is essential to further explore other strategies and actions aimed at more effective learning. In addition, educational policies that emphasise the quality of university studies, continuous improvement, and equity can also benefit from teacher self-regulation. Basically, the aim is to promote sustainable and therefore enduring learning through active teaching methods (e.g., flipped classroom, project-based learning, problem-based learning, challenge-based learning) that meet students' educational needs throughout their academic trajectories. This is linked to the fact that future teachers must become autonomous learners, even more so in the uncertain times we live in today, which require us to be in a constant state of learning. When teachers are capable of self-regulation, they are in a more privileged situation to model and develop learning processes based on autonomy, reflection, metacognition, and self-assessment, which are essential for learning how to learn. Dedicating efforts to promoting self-regulation in the initial education of teachers makes perfect sense because it is here where changes in ideas, attitudes, and ways of exercising the teaching profession begin and, also, because improving education first requires improving the teaching staff who will have to carry it out.

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