Paidéia
2025, Vol. 35, e3505. https://doi.org/10.1590/1982-4327e3505
ISSN 1982-4327 (online version)

CC BY

Profile Analysis of Strategic and Self-Regulated Learning of Future Teachers

Daniel Santos Franciscão[1]
Evely Boruchovitch[1]
Taylor Wayne Acee[2]

Abstract: Strategic and self-regulated learning involves taking control of one's own learning. Strategic and self-regulatory skills can be promoted by teachers, mainly when they are also self-regulated. The aim of this study was to characterize the strategic and self-regulated learning profiles of future teachers. The study included 343 undergraduate students who completed the Learning and Study Strategies Inventory and the Self-Efficacy for Learning Form. The k-mean method was used to cluster the participants according to their scores on these measures. The results revealed three student profiles, with high, moderate and low levels of strategic and self-regulated learning and self-efficacy beliefs. Only a portion of future teachers showed high levels of strategic and self-regulated learning. The need for interventions targeted at increasing future teachers' theoretical and practical knowledge on how to foster strategic and self-regulated learning in their students is highlighted.

Keywords: self-management, metacognition, self-efficacy, cluster analysis, teacher education

Análise dos Perfis da Aprendizagem Estratégica e Autorregulada de Futuros Docentes

Resumo: A aprendizagem estratégica e autorregulada envolve o controle da própria aprendizagem. Habilidades estratégicas e autorregulatórias podem ser promovidas pelos professores, sobretudo quando eles são também autorregulados. O presente estudo teve como objetivo caracterizar os perfis de aprendizagem estratégica e autorregulada de futuros professores. Participaram da pesquisa 343 estudantes que responderam ao Inventário de Estratégias de Estudo e Aprendizagem e ao Formulário de Autoeficácia para a Aprendizagem. Foi utilizado o método de k-mean para agrupar os participantes conforme seus escores nessas medidas. Os resultados revelaram três perfis de estudantes, com níveis alto, moderado e baixo de aprendizagem estratégica e autorregulada e crenças de autoeficácia. Somente uma parcela dos futuros professores apresentou níveis altos de aprendizagem estratégica e autorregulada. Conclui-se pela necessidade de intervenções voltadas para o aumento do conhecimento teórico e prático do futuro professor acerca de como promover as habilidades autorregulatórias em sala de aula.

Palavras-chave: autogestão, metacognição, autoeficácia, análise de conglomerados, formação de professores

Análisis de Perfiles de Aprendizaje Estratégico y Autorregulado de los Futuros Docentes

Resumen: El aprendizaje estratégico y autorregulado implica tomar el control del propio aprendizaje. Las habilidades estratégicas y autorreguladas pueden ser promovidas por los profesores, principalmente cuando ellos también se autorregulan. El objetivo de este estudio fue caracterizar los perfiles de aprendizaje estratégico y autorregulado de futuros profesores. En el estudio participaron 343 estudiantes que completaron el Inventario de Estrategias de Aprendizaje y Estudio y el Formulario de Autoeficacia para el Aprendizaje. Se utilizó el método *k-mean* para agrupar a los participantes según sus puntuaciones en estas medidas. Los resultados revelaron tres perfiles de estudiantes, con niveles alto, moderado y bajo de aprendizaje estratégico y autorregulado y creencias de autoeficacia. Sólo una parte de los estudiantes mostraron altos niveles de aprendizaje estratégico y autorregulado. Destaca la necesidad de intervenciones dirigidas a aumentar los conocimientos teóricos y prácticos de los futuros profesores sobre cómo fomentar el aprendizaje estratégico y autorregulado en sus alumnos.

Palabras clave: autogestión, metacognición, autoeficacia, análisis de conglomerados, formación de professores

[1]*Universidade Estadual de Campinas, Campinas-SP, Brazil*

[2]*Texas State University, San Marcos-Texas, USA*

Article derived from the master's thesis of the first author under the guidance of the second, defended in 2023, in the Postgraduate Program in Education of the Faculdade de Educação of the Universidade Estadual de Campinas. Support: The study received financial support from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) (process nº. 88887.817218/2023-00), the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (processes nº. 403620/2016-3 and 304829/2018-8) and the Fundo de Apoio ao Ensino, Pesquisa e Extensão (FAEPEX -Unicamp) (process nº. 2315/20).

Correspondence address: Evely Boruchovitch. Universidade Estadual de Campinas. Rua Bertand Russell 801. Cidade Universitária Zeferino Vaz - Barão Geraldo, Campinas-SP, Brazil. CEP 13.083-970. E-mail: evely@unicamp.br

Self-regulated learning involves proactive self-management of psychological dimensions linked to learning, such as cognitive, metacognitive, motivational, emotional, and behavioral factors (Zimmerman, 2013). There is consensus among scholars in the area that self-regulated learning approaches positively impact various aspects of students' learning, motivation, performance, and academic trajectories. According to strategic and self-regulated learning approaches, autonomy, adequate use of information processing strategies, management of time, and emotional and motivational regulation are some of the salient characteristics that lead to academic success of students (Weinstein et al., 2000; Wolters & Brady, 2021). Thus, fostering self-regulated learning among students should be one of the major goals of primary and secondary education (Michalsky, 2021; Weinstein et al., 2000).

There is consensus in the literature that teachers who are self-regulated and have knowledge of self-regulated learning approaches tend to be more effective in fostering self-regulated learning in their students. Evidence suggests that teachers need to be highly competent in both identifying students' needs and structuring environments which foster self-regulated learning to promote self-regulated learning in their students (Sáez-Delgado et al., 2022; Stephenson et al., 2024; Zimmerman, 2013). For example, Stephenson et al. (2024) found that teachers who took a course focused on self-regulated learning created more learning situations that promoted self-regulation skills in their classrooms. Sáez-Delgado et al. (2022) identified a positive and significant relationship between teachers' use of self-regulatory skills when preparing and delivering their lessons and students' use of these skills during their studies.

There are several models aimed at explaining self-regulated learning and its subprocesses (Panadero, 2017). Despite their differences, two of them have been frequently used in academic settings, namely: Zimmerman's self-regulated learning model (2000) and the model of strategic learning developed by Weinstein et al. (2000). Zimmerman (2000) has proposed a cyclical model comprising three phases. The forethought phase involves the analysis of the demands of the task, students' motivation and beliefs, establishment of goals, and strategic planning to achieve these goals. The performance phase involves using cognitive and metacognitive learning strategies to perform and monitor task strategies and goal progress. The self-reflection phase involves processes of self-judgment and self-reaction. For example, students may make attributions about the causes of success or failure in learning activities and experience reactions related to these judgements. The insights students gain from engaging these subprocesses during the self-reflection phase function to inform and optimize future forethought and performance on similar tasks (for example, enhancing planning or strategies used). Similarly, self-judgments can strengthen or weaken students' motivational beliefs (Zimmerman, 2013).

Weinstein et al. (2000) proposed a model of strategic learning in which self-regulation is an essential component comprised of various facets. This model supports a dynamic and multidimensional conception of strategic learning that emphasizes the relevance of using cognitive, metacognitive, motivational, and affective learning strategies and developing knowledge of self and the academic environment to become a more strategic learner. The authors defined learning strategies as "any thought, behavior, belief or emotion that facilitates acquisition, understanding or subsequent transfer of new knowledge and skills" (p. 733). The model in fact explores both students' strategic and self-regulated learning.

Weinstein et al. (2000) consider that strategic and self-regulated learning is goal-directed and arises from the interactions between factors within three components that are under the direct control of the students: skill, will and self-regulation components. The skill component refers to knowledge about tasks, personal traits, learning strategies and their conditional use. The will component corresponds to the attitudes, feelings and motivational beliefs involved in learning activities. The self-regulation component emphasizes self-management and metacognitive processes involved in planning, monitoring, and regulating learning, and aspects of skill and will, to facilitate goal attainment (Fong et al., 2023; Weinstein et al., 2000).

Learning and study strategies and self-efficacy beliefs for learning are key variables in both Weinstein et al. (2000) and Zimmerman (2013) theoretical frameworks. Learning and study strategies include cognitive and metacognitive tools used in processing information as well as motivational and affective strategies used to instigate and sustain motivation for learning. They enhance the acquisition, storage, and retrieval of learned information (Seli & Dembo, 2020). Self-efficacy beliefs for learning are self-perceptions about the ability to organize skills and perform a given task (Bandura, 1997). In an academic environment, they represent beliefs regarding the ability to carry out learning activities. Research has shown the importance of self-efficacy beliefs and learning and study strategies for facilitating strategic and self-regulated learning and performance, and that these constructs are usually positively correlated (Lee et al., 2020; Zimmerman, 2000).

Research shows that students use different learning and study strategies and have different beliefs about their abilities. There are therefore individual differences in strategic and self-regulated behavior (Häkkinen et al., 2020; Weinstein et al., 2000; Zimmerman, 2000). Authors such as Häkkinen et al. (2020) and Hertel et al. (2024) argue that person-centered data analysis procedures are useful for identifying such patterns and characterizing student samples in different segments of education. Person-centered approaches make it possible to identify subpopulations of a sample with similar characteristics, depending on the variables chosen, and thus to design interventions targeted at specific groups (Häkkinen et al., 2020; Muwonge et al., 2020; Reindl et al., 2020).

The importance of identifying key variables related to strategic and self-regulated learning, especially among student teachers, both for their academic development and

CC BY

for the promotion of strategic and self-regulated learning in their future students (Seli & Dembo, 2020; Weinstein et al., 2000; Zimmerman, 2013), coupled with the potential of person-centered approaches to identify groups of student teachers who need specific interventions to strengthen their self-regulatory processes (Häkkinen et al., 2020; Muwonge et al., 2020; Reindl et al., 2020), and the scarcity of studies on this theme in Brazil motivated the present research. Thus, the aim of this study was to characterize the strategic and self-regulated learning profiles of future teachers.

The components of strategic and self-regulated learning, as well as participants' self-efficacy beliefs for learning were used to identify specific profiles (clusters) of future teachers. It was expected that these profiles would reflect different levels of self-reported learning and study strategy usage and self-efficacy beliefs for learning. In other words, different profiles of strategic and self-regulated learning were expected to be found.

Method

Participants

The sample consisted of 343 university students regularly enrolled in different teacher education courses at a university in the interior of the state of São Paulo. Participants' age ranged from 18 to 56, averaging 20.9 years old (*SD* = 4, 82), with 196 students (57.31%) under 20, 132 students (38.6%) aged between 20 and 29 and 14 students (4.09%) aged over 30. Of the total sample, 204 (59.48%) were women and 133 (38.78%) men. The number of students who attended high school in public schools (*n* = 164; 47.81%) was close to that of students who attended private education (*n* = 169; 49.27%).

Instruments

Demographic and Academic Life Questionnaire

This instrument had a total of eleven questions: four demographic questions (gender, age, type of high school attended and ethnicity) and seven academic life questions (university, course, area of knowledge of the course, course semester, time of the course, intention to continue undergraduate studies in the following year, and self-perception about course performance). In this study, only the demographic questions were used to characterize the sample.

Learning and Study Strategies Inventory, third edition (LASSI) (Weinstein et al., 2016) – version translated by Boruchovitch et al. (2019)

The inventory has 60 items that measure the use of learning and study strategies from different dimensions related to students' strategic and self-regulated learning. The items are on a Likert-type scale, with five response options ranging from (1) *Not at all like me* to (5) *Very much like me*. The 60 items are grouped into ten subscales: Anxiety, Attitude, Concentration, Information Processing, Motivation, Selecting Main Ideas, Self-Testing, Test Strategies, Time Management and Using Academic Resources.

The following are examples of items in each of the subscales: "When I am studying, worrying about doing poorly in a course interferes with my concentration." (Anxiety); "I have a positive attitude about attending classes" (Attitude); "My mind wanders a lot when I study." (Concentration); "To help me remember new principles we are learning in class, I practice applying them." (Information Processing); "When work is difficult I either give up or study only the easy parts." (Motivation); "I have difficulties identifying important points in my reading." (Selecting Main Ideas); "stop periodically while reading and mentally go over or review what was said." (Self-testing); "I have difficulty adapting my studying to different types of courses." (Test Strategies); "I set aside more time to study the subjects that are difficult for me." (Time Management); "I am not comfortable asking for help from instructors in my courses." (Using Academic Resources).

All subscales of this inventory are conceptually related to the three components of strategic and self-regulated learning (skill, will and self-regulation), which, despite having some overlap among them, represent different dimensions of strategic and self-regulated learning. The skill component, made up of the Information Processing, Main Idea Selection and Test-taking Strategies subscales, refers to the cognitive dimension. The will component comprises the subscales Anxiety, Attitude, and Motivation and addresses the motivational-affective dimension. The self-regulation component refers to the Concentration, Self-testing, Time Management and Use of Academic Resources subscales and focuses on self-management and metacognitive processes involved in proactive and intentional planning, monitoring and regulation of learning, cognition, motivation, and emotion (Fong et al., 2023; Weinstein, 2000).

Each of the subscales has six items, so the maximum score in each scale ranges from 6 to 30 and the average score from 1 to 5. The 10 subscales are designed to be examined individually for diagnostic and prescriptive purposes (Weinstein et al., 2016). The total LASSI average score obtained by averaging all 60 items has been used in research as a measure of participants' overall strategic and self-regulated learning (Weinstein et al., 2016).

The process of translating and adapting the third edition of the Learning and Study Strategies Inventory (LASSI) was undertaken and thoroughly described by Boruchovitch et al. (2019). Alphas of Cronbach coefficient of LASSI total scale and individual subscales were also calculated in the present study. The internal consistency of the total scale was 0.92. The values for individual subscales ranged from 0.69 to 0.89. The Using Academic Resources subscale was the only one to have an alpha coefficient below 0.60 and was therefore unsatisfactory (0.53). Moreover, the alphas of Cronbach of the three components of LASSI (skill, will and self-regulation) were, respectively, 0.86, 0.80, 0.85.

Self-Efficacy for Learning Form (SELF) (Zimmerman & Kitsantas, 2007) - Translated version for use in Brazil

The original version of this scale was initially developed with 59 items, designed to cover both self-efficacy beliefs about the use of learning and study strategies and self-efficacy beliefs about dealing with variety of learning situations. The internal validity analysis carried out by the original authors resulted in five factors, but four of them were disregarded due to the small size and heterogeneity of the items they comprised. The only valid factor, "Self-efficacy Beliefs for Learning", aggregated the remaining items and showed high internal consistency ($\alpha = 0.96$). The authors argued that, as this is a single-factor scale, reduced versions can be used just as effectively as the longer one. They, for example, used a shortened scale of 19 items and obtained a single factor with a Cronbach's alpha value of 0.97 (Zimmerman & Kitsantas, 2007). This same shortened scale was used in the present study, in its version translated into Portuguese, with the consent of the original authors. This instrument measures students' self-efficacy beliefs for learning in academic activities.

The 19 items of this instrument are organized on a Likert-type scale. The answer choices vary in increments of 10% from 0% to 100% and use labels as follows: 0% (Definitely cannot do it), 30% (Probably cannot do it), 50% (Might be able to do it), 70% (Probably can do it) and 100% (Definitely can do it). Example items include, item 7 "When you are trying to understand a new topic, can you associate new concepts with old ones sufficiently well to remember them*?*" your notes and locate all the information you had forgotten*?*". The total score of the scale ranges from 0 to 100 and is obtained by averaging the scores obtained on the 19 items. High values in the total scale indicate high self-efficacy beliefs for learning. The Cronbach's alpha value obtained in the sample was 0.89, similar to those found in other studies carried out by the authors on Brazilian samples.

Procedures

Data collection. Data was collected online in virtual environments (Google Meet or Zoom), given the suspension of in-person activities in higher education institutions between 2020 and 2021 due to the COVID-19 pandemic. First, all teacher education courses offered at the university where the research occurred were obtained. Then, authorization was obtained from course coordinators to contact teachers who taught courses comprised of student teachers. Finally, data collections were scheduled. Before data collection began, participants were provided with information about the research and its objectives, students were informed that participation was voluntary and only permissible for those over 18 years old. Those who were interested and met the age inclusion criterion were invited by e-mail to take the survey on the "*Autorregular*" platform. The "*Autorregular*" platform corresponds to the electronic address where the data collection instruments were hosted, and the data were saved. It was also designed to guarantee confidential and de-identified data. On this platform, participants initially filled in the informed consent form and then answered LASSI and the Self-Efficacy for Learning Form. The entire process was supervised by the first two authors of this paper. After answering the instruments, participants received a chart describing their performance in each of the LASSI scales. It was emphasized that the results were based on a US instrument that was still being adapted and validated for use in Brazil and may not necessarily reflect the experiences of Brazilian students (Boruchovitch et al., 2019). Data were collected in a total of 36 courses.

Data analysis. All statistical analyses were carried out using The SAS System for Windows (Statistical Analysis System), version 9.4. The analysis of strategic and self-regulated learning profiles was based on both the model of strategic learning (Weinstein et al., 2000) and Zimmerman's (2000) self-regulated learning model. The skill, will and self-regulation components, the total score obtained on the LASSI and the self-efficacy beliefs for learning were used as variables in the construction of the profiles by k-means clusters. Some criteria justify the choice of this type of clustering over other probabilistic statistical methods, such as Latent Profile Analysis (LPA) or even hierarchical clustering methods. Firstly, k-means clusters tend to be more parsimonious, that is, they produce simpler profiles (Härdle et al., 2024), which is desirable for guiding psychoeducational interventions. Secondly, research shows that strategic and self-regulatory variables usually give rise to 2 to 4 valid student profiles (Häkkinen et al., 2020; Muwonge et al., 2020; Reindl et al., 2020), making it possible to first determine and then validate the ideal number of profiles (k) to analyze.

After standardizing the scores, values of k=2, k=3 and k=4 were then established. As not all values of k represent optimal solutions, each of the solutions underwent validation. There are several ways of validating cluster analyses according to the literature (Everitt et al., 2011). One of the alternatives involves comparing the measures of heterogeneity and homogeneity of the profiles obtained. These internal validation measures consider the compression in the profiles and the separation between them (Härdle et al., 2024). Compression measures, such as the Mean Squared Deviation and the Maximum Distance between the Centroid and the Observations, measure the difference between the cases in the same profile. Thus, the lower the values, the greater the homogeneity. Measures of separation, such as R^2 and Distance between Cluster Centers, indicate the distance between two profiles. Higher values show that two distinct profiles are heterogeneous and therefore well delimited. Regarding the separation measures, an increase in the number of profiles inevitably leads to an increase in the R^2 values. We therefore assessed whether the gain in explanatory power compared to the other solutions was substantial, or just a consequence of the increase in the number of profiles in the solution. Initially, solutions with two, three and four profiles were tested and analyzed. The decision on the most appropriate one considered theoretical parsimony and the measures of homogeneity and heterogeneity of the profiles (clusters). Significant differences were assessed by comparing the average scores of the profiles in each solution using the Mann-Whitney and Kruskal-Wallis tests. All the analyses carried out in this study adopted a significance level of 5%, i.e., $p < 0.05$.

Ethical Considerations

This study is part of a project previously submitted to and approved by the Ethics Committee of the State University of Campinas, CAAE No. 81094017.0.0000.8142, certifying its compliance with ethical and legal issues involving research with human beings in Brazil (National Health Council, Resolution 506/16).

Results

As described previously, strategic and self-regulated learning profiles were obtained by analyzing k-means clusters. Possible solutions were estimated with two, three and four profiles. Table 1 shows the descriptive and comparative statistics of the profiles generated in each of the proposed solutions.

Table 1

Descriptive and comparative statistics between clusters obtained in each student clustering solution

Cluster	Variable	*n*	Mean	*SD*	Median	*Z*	*p**
			Solution 1				
1	SEL	179	75.27	8.91	75.26	13.20	**<0.001**
	LASSI	176	3.68	0.26	3.64	15.73	**<0.001**
	Skill	176	4.08	0.36	4.06	12.78	**<0.001**
	Will	176	3.96	0.35	3.94	12.26	**<0.001**
	Self-Regulation	176	3.18	0.42	3.17	13.03	**<0.001**
2	SEL	167	57.04	10.57	57.89		
	LASSI	167	2.94	0.32	3.02		
	Skill	167	3.29	0.50	3.28		
	Will	167	3.28	0.46	3.33		
	Self-Regulation	167	2.41	0.41	2.38		
			Solution 2				
						X2	*p***
1	SEL	195	66.23	8.96	66.84	192.02	**<0.001a,b**
	LASSI	195	3.33	0.21	3.33	265.48	**<0.001a,b**
	Skill	195	3.72	0.40	3.72	190.32	**<0.001a,b**
	Will	195	3.67	0.34	3.67	187.62	**<0.001a,b**
	Self-Regulation	195	2.78	0.39	2.79	192.10	**<0.001a,b**
2	SEL	70	50.59	10.11	51.05		
	LASSI	70	2.63	0.25	2.65		
	Skill	70	2.96	0.43	3.00		
	Will	70	2.94	0.40	2.94		
	Self-Regulation	70	2.16	0.32	2.17		
3	SEL	78	80.98	7.39	81.32		
	LASSI	78	3.92	0.18	3.88		
	Skill	78	4.30	0.29	4.28		
	Will	78	4.16	0.30	4.17		
	Self-Regulation	78	3.45	0.36	3.42		
			Solution 3				
1	SEL	142	68.85	7.92	68.95	208.76	**<0.001c,d,e**
	LASSI total	142	3.44	0.16	3.43	300.25	**<0.001c,d,e**
	Skill	142	3.90	0.35	3.86	230.48	**<0.001c,d,e**
	Will	142	3.72	0.34	3.72	191.51	**<0.001c,d,e**
	Self-Regulation	142	2.90	0.36	2.88	218.64	**<0.001c,d,e**

Cluster	Variable	*n*	Mean	*SD*	Median	*Z*	*p**
2	SEL	85	58.74	9.09	58.95		
	LASSI total	85	3.01	0.15	3.02		
	Skill	85	3.28	0.32	3.28		
	Will	85	3.45	0.38	3.44		
	Self-Regulation	85	2.49	0.32	2.50		
3	SEL	73	81.40	7.41	81.58		
	LASSI total	73	3.93	0.18	3.90		
	Skill	73	4.29	0.29	4.28		
	Will	73	4.18	0.29	4.17		
	Self-Regulation	73	3.47	0.36	3.46		
4	SEL	43	47.96	10.11	48.42		
	LASSI total	43	2.48	0.19	2.55		
	Skill	43	2.83	0.39	2.89		
	Will	43	2.77	0.32	2.83		
	Self-Regulation	43	2.01	0.25	2.00		

Note. * *p*-value referring to the Mann-Whitney test for comparing variables between 2 groups. *Z*=Z statistic of the test. ** *p*-value referring to the Kruskal-Wallis test for comparing variables between 3 or more groups. X^2=$\chi 2$ test statistic. (a) Significant differences between clusters: 1≠ (2,3) (b) Significant differences between clusters: 2≠3 (c) Significant differences between clusters: 1≠ (2,3,4) (d) Significant differences between clusters: 2≠ (3,4) (e) Significant differences between clusters: 3≠4

In each of the three solutions, statistically significant differences emerged between the profiles. Solution 1 grouped into a profile students who had high scores in strategic and self-regulated learning (skill, will and self-regulation components and total LASSI score) and in self-efficacy beliefs for learning. The other profile grouped students who scored low in all those variables. In solution 2, students with moderate scores in all variables generated a profile. Those with low scores in all variables made up the second profile. Students with high scores in all variables were grouped in the third profile. Solution 3 included, in the first profile, students with high intermediate scores in all variables. The second profile was comprised of students with low intermediate scores in all variables. In the third, those with high scores in all variables were grouped. Finally, the fourth profile grouped students with low scores in all variables.

As mentioned in the data analysis procedures section, the next stage involved validating each of these solutions. The most appropriate solution was decided according to the internal validation measures and theoretical parsimony. Table 2 shows the internal measures used in the process.

Table 2

Mean Squared Deviation, Maximum Distance between Centroids and Observations, Distance between Cluster Centers and R^2 obtained in each student clustering solution.

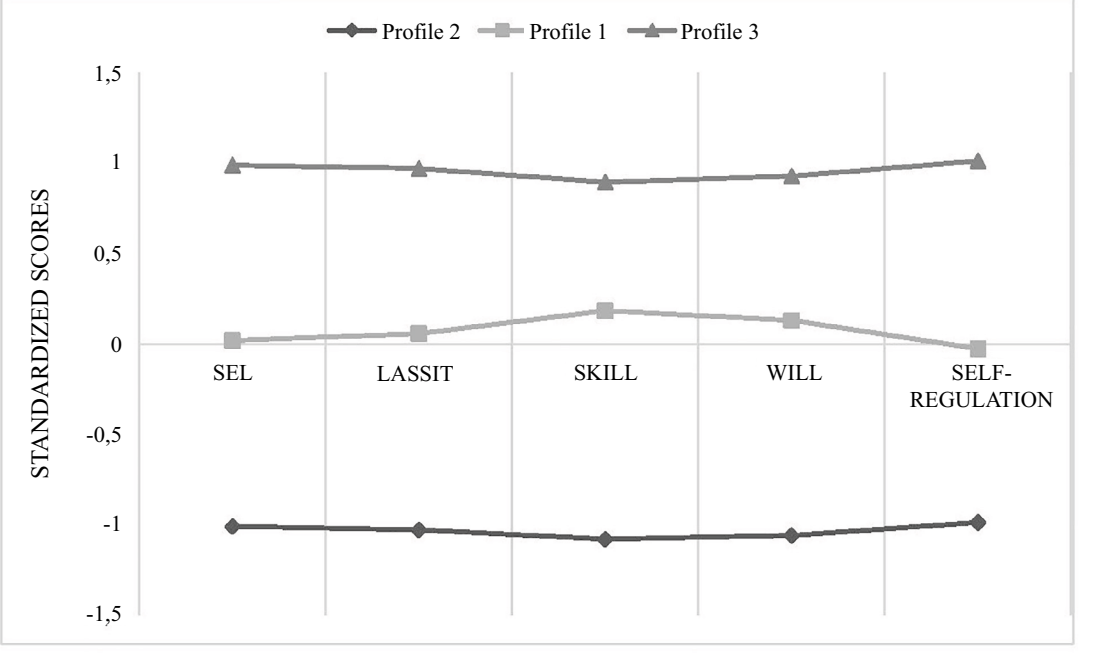
Profile	Freq.	Mean squared deviation	Maximum distance between centroids and observations	Closest cluster	Distance between cluster centers
Solution 1 – R^2 = .482					
1	176	0.6510	3.8121	2	3.1017
2	167	0.7876	3.5967	1	3.1017
Solution 2 – R^2 = .613					
1	195	0.6360	2.8071	3	2.4518
2	70	0.6767	2.5348	1	2.8877
3	78	0.5348	2.5683	1	2.4518

Profile	Freq.	Mean squared deviation	Maximum distance between centroids and observations	Closest cluster	Distance between cluster centers
			Solution 3 – R^2 = .678		
1	142	0.5736	2.1822	2	1.8156
2	85	0.5828	2.5988	1	1.8156
3	73	0.5322	2.5683	1	2.0453
4	43	0.5933	2.5601	2	2.1987

The proposition with two profiles had the greatest distance between the cluster centers, which means that the profiles are more distinct compared to the other solutions. However, it had higher values in measures that indicate heterogeneity, when compared to the propositions with three and four profiles. In other words, although the profiles are different from each other, they showed greater internal differences when compared to the other solutions. The solutions with three and four profiles had similar compression measures (Mean Square Deviation and Maximum Distance between Centroid and Observations). However, the solution with three profiles showed better separation measures. It had higher values for the distance between cluster centers and a greater relative gain in R^2. In this sense, the gain from Solution 1 (with two profiles; R^2 = .482) to Solution 2 (with three profiles; R^2 = .613) was greater than from Solution 2 to Solution 3 (with four profiles; R^2 = .678). From a theoretical point of view, it can be said that the solutions with three and four profiles were equally supported by the literature (Häkkinen et al., 2020; Muwonge et al., 2020; Reindl et al., 2020). However, given the lower compression measures of Solution 1 and the higher separation measures of Solution 2 compared to Solution 3, the decision was to choose the one with three profiles over the others. Figure 1 illustrates the standardized scores of the profiles obtained in Solution 3.

Figure 1

Standardized scores of the clusters obtained in Solution 3



Note. SEL= Self-efficacy beliefs for learning; LASSIT= LASSI total score; SKILL= skill component; WILL = will component; SELF-REGULATION = self-regulation component.

Profile 1 grouped 195 students (56.8%) with moderate scores in the four investigated variables. Profile 2 comprised 70 students (20.2%) who obtained low scores in all variables. Profile 3 comprises 78 students (22%) who achieved high scores in all variables. The people-centered data analysis procedure suggested that a quarter of the students (profile 2) reported underutilization of effective and efficient cognitive learning strategies in reaching academic goals (skill component), relatively lower engagement in proactively self-managing learning processes and outcomes (self-regulation component), and more negative attitudes, feelings, and motivational beliefs about learning (will component), and more self-doubt in their capabilities to successfully engage in effective learning across various academic activities (self-efficacy for learning). It was also found that more than half of the students (profile 1) could be identified as relatively moderate in their strategic and self-regulated learning attributes. The remaining quarter of students (profile 3) showed relatively high self-reported strategic and self-regulated learning characteristics across all the measured areas.

Discussion

The aim of this study was to characterize the strategic and self-regulated learning profiles of future teachers. Four possibilities for organizing student teachers into profiles were identified. Among them, the most appropriate, according to the measures of homogeneity and separation and of theoretical parsimony, was composed of three profiles.

The cluster analysis conducted in the current study corroborated the initial hypothesis that students would present different strategic and self-regulated learning profiles. It also reinforced Zimmerman's theoretical framework (2013) and research evidence (Häkkinen et al., 2019; Muwonge et al., 2020; Reindl et al., 2020) by showing that students use learning and study strategies heterogeneously and, therefore, have different strategic and self-regulated learning profiles. It was interesting to note that the high, moderate and low profiles were consistent across all the variables, and no evidence was found of a profile that was, for example, high in one variable and low in another. It is also believed that this data provides initial evidence of the congruence between the components of strategic and self-regulated learning theoretically explored by the instrument, which should be examined by future research.

Results of this study were somewhat similar to those found in the literature. In their work, Muwonge et al. (2020) found three distinct profiles of strategic and self-regulated learning in higher education students. Findings of the studies by Häkkinen et al. (2020) and Reindl et al. (2020) revealed the formation of two and four profiles of strategic and self-regulated learning, respectively. Häkkinen et al. (2020) found, as in the present study, that the most frequent profile in their sample was that of moderate strategic and self-regulated behavior. On the other hand, in the research by Muwonge et al. (2020) and Reindl et al. (2020), the most frequent profile was one that showed a high level of strategic and self-regulated behavior. It is thus hypothesized that the differences found could be attributed to factors such as psychological variables explored in the studies, cultural differences in teaching and learning in each country, different learning domains (participants' courses), data collection instruments used, different methodological approaches employed to identify profiles, among others (Häkkinen et al., 2020; Muwonge et al., 2020; Reindl et al., 2020). It is important to mention that the specific combination of data collection instruments and psychological variables used in the present study has not been employed in other research in literature. This, in turn, makes it difficult to accurately explain differences with other similar studies. From a theoretical point of view, these differences can also be interpreted as manifestations of the complexity of the strategic and self-regulated learning construct (Panadero, 2017; Weinstein et al., 2000; Zimmerman, 2013) and should inspire further research.

The finding that less than a quarter of future teachers showed high levels of strategic and self-regulated learning deserves attention. Intermediate levels are not enough to deal with the challenges of higher education, nor do they enable future teachers to identify the needs of their students and promote strategic and self-regulated learning in the classroom efficiently (Michalsky, 2021; Sáez-Delgado et al., 2022; Stephenson et al., 2024). However, it is important to highlight the potential of this finding for future interventions, since it makes it possible to identify specific student needs that could be addressed in interventions for students in the two profiles that indicated the most room for growth (i.e., low and intermediate levels). Fostering strategic and self-regulated learning for students in these profiles could benefit their learning and their effectiveness as future teachers.

Although this study has contributed to the understanding of student teacher's strategic and self-regulated learning and self-efficacy beliefs for learning, it also has some limitations that must be addressed and overcome by future research. The first concerns the translated versions of the instruments used. Although both have demonstrated strong psychometric properties in terms of internal consistency, as measured by Cronbach's alpha, their validation studies are still in progress, which prevents us from stating with certainty that the structures proposed in the respective theoretical models have empirical support.

More precisely, with regard to the LASSI, although this inventory showed high internal consistency, similar to that obtained in the original studies with North American samples (Weinstein et al., 2016), one of its ten subscales, Academic Resource Use, obtained low internal consistency in Brazilian samples. It is therefore essential that future research examines this subscale in more detail. The scores obtained in the self-regulation component, of which this subscale is a part, should therefore be interpreted with caution. It is possible that cultural and language differences between Brazilian and North American students may have occurred which deserve further investigation (Fong et al., 2023).

Furthermore, the fact that the data were collected using self-report instruments is another limitation to be considered, since the participants' responses may have been influenced by social desirability. Finally, it should also be noted that the sample of future teachers in this study belongs to one of Brazil's most prestigious public universities. This data cannot be generalized to all future teachers enrolled in teacher education programs in the country.

It is recommended that future research be aimed at measuring the key variables of self-regulated learning with instruments other than self-reporting ones, as well as at advancing validation studies of the scales used in the present study in larger and more representative samples, so that these constructs can be measured in a more valid, reliable and diverse way.

Despite the limitations of this study, it is hoped that its findings will contribute to improve academic and practical knowledge about strategic and self-regulated learning, as well as the self-efficacy beliefs for learning of future teachers. It is also believed that data gathered in the present study will reinforce the benefits of using student-centered analysis procedures, guiding the design of interventions more focused on providing more tailored support for students based on their strengths and areas for growth identified in their strategic and self-regulated learning profiles. Furthermore, the relevance of incorporating strategic and self-regulated learning into teacher education programs is highlighted. It is thus essential that teacher education programs include in their curriculum, subjects and practices focused not only on increasing knowledge about self-regulated learning, but also on developing self-regulatory skills and beliefs that facilitate learning (Michalsky, 2021; Muwonge et al., 2020; Stephenson et al., 2024; Weinstein et al., 2000). Such efforts will certainly make future teachers more active, responsible, strategic, self-regulated and more qualified to teach, with the aim of developing strategic and self-regulated students.

References

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Worth Publishers.

Boruchovitch, E., Góes, N. M., Felicori, C. M., & Acee, T. W. (2019). Translation and adaptation of the learning and study strategies inventory - LASSI 3rd edition for use in Brazil: Methodological considerations. *Educação em Análise, 4*(1), 7–20. https://ojs.uel.br/revistas/uel/index.php/educanalise/article/view/35527

Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). *Cluster analysis* (5th ed.). John Wiley & Sons.

Fong, C. J., Lee, J., Krou, M. R., Hoff, M. A., Johnston-Ashton, K., Gonzales, C., & Beretvas, S. N. (2023). Meta-Analyzing the factor structure of the learning and study strategies inventory. *The Journal of Experimental Education, 91*(2), 380-400. https://doi.org/10.1080/00220973.2021.2021842

Häkkinen, P., Virtanen, T., Virtanen, A., Näykki, P., Pöysä-Tarhonen, J., Niilo-Rämä, M., & Järvelä, S. (2020). Finnish pre-service teachers' perceptions of their strategic learning skills and collaboration dispositions. *Journal of Education for Teaching*, *46*(1), 71–86. https://doi.org/10.1080/02607476.2019.1708628

Härdle, W. K., Simar, L., & Fengler, M. R. (2024). Cluster analysis. In W. K. Härdle, L. Simar, & M. R. Fengler. *Applied multivariate statistical analysis.* Springer.

Hertel, S., Reschke, K., & Karlen, Y. (2024). Are profiles of self-regulated learning and intelligence mindsets related to students' self-regulated learning and achievement? *Learning and Instruction*, *90*, 101850. https://doi.org/10.1016/j.learninstruc.2023.101850

Lee, D., Watson, S. L., & Watson, W. R. (2020). The relationships between self-efficacy, task value, and self-regulated learning strategies in Massive Open Online Courses. *The International Review of Research in Open and Distributed Learning, 21*(1), 23–39. https://doi.org/10.19173/irrodl.v20i5.4389

Michalsky, T. (2021). Preservice and inservice teachers' noticing of explicit instruction for self-regulated learning strategies. *Frontiers in Psychology, 12*, 630197. https://doi.org/10.3389/fpsyg.2021.630197

Muwonge, C. M., Ssenyonga, J., Kibedi, H., & Schiefele, U. (2020). Use of self-regulated learning strategies among teacher education students: A latent profile analysis. *Social Sciences & Humanities Open*, *2*(1), 100037. https://doi.org/10.1016/j.ssaho.2020.100037

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, *8*, 422. https://doi.org/10.3389/fpsyg.2017.00422

Reindl, M., Tulis, M., & Dresel, M. (2020). Profiles of emotional and motivational self-regulation following errors: Associations with learning. *Learning and Individual Differences*, *77*, 101806. https://doi.org/10.1016/j.lindif.2019.101806

Sáez-Delgado, F., López-Angulo, Y., Mella-Norambuena, J., Baeza-Sepúlveda, C., Contreras-Saavedra, C., & Lozano-Peña, G. (2022). Teacher self-regulation and its relationship with student self-regulation in secondary education. *Sustainability*, *14*(24), 16863. https://doi.org/10.3390/su142416863

Seli, H., & Dembo, M. H. (2020). *Motivation and learning strategies for college success: A focus on self-regulated learning* (6th ed.). Routledge.

Stephenson, H., Lawson, M. J., Nguyen-Khoa, L. A., Kang, S. H. K., Vosniadou, S., Murdoch, C., Graham, L., & White, E. (2024). Helping teacher education students' understanding of self-regulated learning and how to promote self-regulated learning in the classroom. *Frontiers in Education, 9*. https://doi.org/10.3389/feduc.2024.1451314

Weinstein, C. E., Husman, J., & Dierking, D. R. (2000). Self-regulation interventions with a focus on learning strategies. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 727–747). Academic Press.

Weinstein, C. E., Palmer, D. R., & Acee, T. W. (2016). *LASSI - Learning and Study Strategies Inventory.* 3rd ed. H&H Publishing.

Wolters, C. A., & Brady, A. C. (2021). College students' time management: A self-regulated learning perspective. *Educational Psychology Review, 33*(4), 1319–1351. https://doi.org/10.1007/s10648-020-09519-z

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). Academic Press.

Zimmerman, B. J. (2013). From cognitive modeling to self-regulation: A social cognitive career path. *Educational Psychologist*, *48*(3), 135–147. https://doi.org/10.1080/00461520.2013.794676

Zimmerman, B., & Kitsantas, A. (2007). Reliability and validity of self-efficacy for learning form (SELF) scores of college students. *Journal of Psychology, 215*(3), 157–163. https://doi.org/10.1027/0044-3409.215.3.157

Daniel Santos Franciscão is a Ph.D. candidate of the Faculdade de Educação at the Universidade Estadual de Campinas, Campinas-SP, Brazil.

Evely Boruchovitch is a Professor of the Faculdade de Educação at the Universidade Estadual de Campinas, Campinas-SP, Brazil.

Taylor Wayne Acee is a Professor of the Department of Curriculum and Instruction at the Texas State University, San Marcos-Texas, USA

Authors' Contribution:
All authors made substantial contributions to the conception and design of this study, to data analysis and interpretation, and to the manuscript revision and approval of the final version. All the authors assume public responsibility for content of the manuscript.

Associate editor:
Vanessa Barbosa Romera Leme

Received: Aug. 19, 2024
1st Revision: Nov. 12, 2024
Approved: Nov. 18, 2024

How to cite this article:
Franciscão, D. S., Boruchovitch, E., & Acee, T. W. (2025). Profile analysis of strategic and self-regulated learning of future teachers. *Paidéia (Ribeirão Preto), 35,* e3505. https://doi.org/10.1590/1982-4327e3505