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Self-regulated Learning and Scientific Reading in Pre-service Teachers. An Exploratory Study

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Abstract

Two skills that need improvement during the university stage are self-regulated learning (SRL) and the reading of scientific texts. The objective of this study is to assess SRL, the profile of scientific reading, and the relationship between these variables in a sample of 1,253 students pursuing a Bachelor's degree in Early Childhood and Primary Education. A descriptive and cross-sectional selective study was designed. A digital questionnaire was administered, including socio-demographic data, the range of scientific articles read in a semester, and the adapted SRSI-SR instrument to measure SRL. The results revealed significant differences in the mean SRL score in favour of women but not by the degree studied or the academic year. The range of scientific readings was less than three scientific articles per semester for more than half of the sample, with better results in women and second-year students. All scores on the adapted SRSI-SR scale improved with an increase in scientific reading. These findings suggest that increasing scientific reading in education students can enhance their self-regulated learning skills, also promoting critical thinking and voluntary selection of scientific readings by students.

Keywords: Reading comprehension; scientific literacy; learning strategies; Higher Education; preservice teacher education; teacher education curriculum.

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Autorregulación del aprendizaje y lectura científica en docentes en formación. Un estudio exploratorio

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Resumen

Dos habilidades que han de mejorarse en la etapa universitaria son el aprendizaje autorregulado (ARA) y la lectura de textos científicos. El objetivo de este estudio fue evaluar ARA, el perfil de lectura científica y la relación entre estas variables en una muestra de 1.253 estudiantes de Grado en Maestro en Educación Infantil y Primaria. Se planteó un estudio descriptivo de tipo selectivo y transversal. Se administró un cuestionario digital que incluía datos sociodemográficos, el rango de artículos científicos leídos en un cuatrimestre y el instrumento SRSI-SR adaptado para medir ARA. Los resultados evidenciaron diferencias significativas en la puntuación media en ARA a favor de las mujeres, pero no por grado estudiado o curso. El rango de lecturas científicas fue inferior a tres artículos científicos al cuatrimestre para más de la mitad de la muestra con mejores resultados en mujeres y en estudiantes de segundo curso. Todas las puntuaciones de la escala SRSI-SR adaptada mejoran con el aumento de la lectura científica. Estos hallazgos sugieren que incrementar la lectura científica en estudiantes de educación, puede mejorar sus habilidades de autorregulación del aprendizaje, fomentando también el pensamiento crítico y la elección voluntaria de lecturas científicas por parte del estudiantado.

Palabras clave: Comprensión lectora; alfabetización científica; estrategias de aprendizaje; Educación Superior; estudiante de educación; currículo del Grado en Maestro.

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INTRODUCTION

Higher Education represents a significant change in the cognition of those who pursue it, as the development of independent, self-directed and self-regulated learning skills is required to achieve academic success (Vosniadou, 2020). In contrast to secondary education, where the use of one textbook per subject is common, university subjects usually offer extensive lists of bibliographical references, including numerous scientific articles. This change requires university students to acquire a new reading profile that enables them to read academic texts fluently and regularly, and to take charge of their own learning.

Self-regulated learning (SRL) refers to cognitive, metacognitive, motivational and emotional processes that students initiate themselves to achieve their learning goals (Zimmerman & Schunk, 2017). This approach involves setting and adjusting goals, planning and monitoring the learning process, evaluating performance and using adaptive strategies to improve learning outcomes. In the university context, SRL is intended to lead to meaningful and sustainable learning beyond the academy, becoming a lifelong process throughout students' professional lives (Eekelen et al., 2005).

SRL is presented as a critical element for academic success and scientific activities such as research, problem solving and reasoning (Sinatra & Taasoobshirazi, 2017). Trainees must not only monitor and regulate their learning process, but also set goals, choose strategies, and monitor their performance and goals (Virtanen et al., 2017). Improving self-regulation of the learning process contributes to the development of metacognitive skills, academic performance, reflective processes, self-assessment and student motivation (Muchiut et al., 2018). Furthermore, proficiency in self-regulated learning has been associated with lower levels of anxiety and burnout in university students (Näykki et al., 2018).

On the other hand, reading scientific articles is an important challenge for future teachers in their learning process. Although reading skills have been developed since primary school, engaging with academic texts requires familiarity with technical terminology and sophisticated analysis of results (Cabrera-Pommiez et al., 2021; Wise, 2021). Academic reading goes beyond the mere reception of information; it requires an active stance to analyse, reflect and interpret data, thus contributing to students' scientific literacy process (Dori et al., 2018).

Despite the importance of academic reading, future teachers have been shown to be immature readers, with a preference for novels, fiction and commercial works, and little commitment to academic reading, except in the area of social networks (Alcocer-Vázquez & Zapata-González, 2021; Cabrera-Pommiez et al., 2021; García-Gutiérrez et al., 2019; Granado & Puig, 2014). While social media can be effective in encouraging reading, it does not develop the same skills needed to interact with scientific articles. For example, life science students have difficulty understanding the structure and technical language of these texts and focus on superficial information compared to more experienced students (Hubbard & Dunbar, 2017). In this way, scientific literacy becomes a key process for strengthening the critical capacity needed to understand and analyse texts specific to the field of study (Cardona Puello et al., 2018). Furthermore, students tend to rely on the interpretation provided in scientific texts rather than seeking and analysing evidence for themselves (Lennox et al., 2020).

Reading habits create a different pattern of attitudes between readers and non-readers, reflecting greater reading comprehension and analytical skills in the former (Larrañaga-Rubio & Yubero, 2005). However, data on the frequency and reading habits of higher education students show inconsistent patterns, with low percentages of regular readers and a greater preference for occasional reading or even no reading habits (Cardona-Puello et al., 2018; Caride et al., 2018). In terms of reading scientific texts, the engagement of university students is generally limited (García-Gutiérrez et al., 2019). In addition, it is necessary not only to increase the frequency of reading, but also to deepen the understanding of expository texts. Research focusing on scientific thinking and literacy highlights the importance of developing scientific literacy during teacher training in faculties of education (Torrijos-Muelas et al., 2023).

OBJECTIVES

Scientific reading should be an indispensable part of the academic curriculum, especially in the case of education students, who will be trainers and transmitters of scientific knowledge. This knowledge is complemented by the autonomous learning outcomes expected of those completing a stage of higher education. It is from this combination that this article derives its main objectives:

- To describe the learning self-regulation skills of a sample of Bachelor of Education students and to explore this characteristic in relation to the socio-demographic data of the participants.

- To find out the range of scientific reading done by Bachelor of Education students during a four-month period, by comparing the sample in groups according to the socio-demographic information collected.

- To explore whether there is a difference in the ability to self-regulate learning according to the range of scientific reading over a four-month period in the research sample.

METHOD

Design of the research

According to Ato et al. (2013), this research proposes a non-experimental study using a selective descriptive strategy, in this particular case recording the behaviour of the sample studied. In terms of the methodological component, the research is descriptive in that it seeks to detail specific characteristics of the target population through the estimation of sample parameters (Ato et al., 2013). As the variables were measured at a single point in time and in a group of participants with common characteristics (degree studied and university), but it is unknown whether the study variables are correlated, the design is cross-sectional (Ato et al., 2013; Spector, 2019).

Participants

The sample consisted of 1,253 students from a Spanish public university enrolled in a Bachelor's degree in Early Infant Education (32.7%) and a Bachelor's degree in Primary Education (67.3%). Participation in research represents 34.12% of the total number of students in these programmes at the sampled university. The Bachelor's degree in Primary Education has more than twice as many groups as the Bachelor's degree in Infant Education and 50% more enrolments. The mean age of the participants is 20.78 years (range 18-49 years; SD = 3.257). Men accounted for 24.3% of those surveyed, while 74.9% said they were women. These data correspond to the gender ratio of the population in these grades, where 71.45% are female and 28.54% are male. Although the university does not provide information on other gender identifications, the survey includes options such as 'prefer not to answer' and 'other gender', with a low percentage of responses received that were excluded from further analysis due to lack of representativeness.

Almost 60% of the sample entered university with a bachelor's degree in social sciences or humanities, and less than 1% of the prospective teachers had a previous university degree (table 1).

Table 1

Characteristics of the sample

Variable	Options	%
Gender identified	Woman	74.9
	Man	24.3

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Variable	Options		%
	I would rather not answer		.8
	Transgender		.1
Grade	Infant education		32.7
	Primary education		67.3
Year	First year		40.2
	Second year		29.9
	Third year		20.4
	Fourth year		9.4
Previous studies leading to admission to the university	GCE	Social Science	39.5
		Humanities	19.2
		Technology	4.5
		Health Sciences	17.4
		Arts	1.8
		Music	.1
	Higher level training cycle		15.7
	Admission exam >25 years		.7
	Admission exam >45 years		.1
	3-year bachelor's degree		.3
	Year		.4
	Other Older Schemes		.2

Procedure

In this study, the main variables were the number of articles read in the previous semester and the self-regulation learning skills of education students. Data collection was deliberately conducted in the second semester to ensure that first year students would provide data on their university reading. Despite the fact that final year students complete the final year dissertation, the faculties surveyed schedule this subject in the second semester, thus avoiding a distortion of the scientific reading data related to the completion of the theoretical framework of the final year dissertation.

Participants were selected by convenience sampling during compulsory classes in the first two weeks of the second semester. Consent was obtained from the responsible teacher to use 20 minutes of the session, and equipment with internet access was provided to ensure equal access to participation. Ethical approval was obtained prior to data collection under reference CEIS-631156-N6M6, and participants gave informed consent. The online survey was securely stored on university servers, and those who chose not to participate remained in the classroom without written consent.

Instrument

An electronic questionnaire (appendix A) was designed to collect data using internet-connected devices. The tool began by emphasising that participation was voluntary and anonymous, and asked again for permission to start the survey. Socio-demographic data were collected, including gender, level of education (early childhood or primary), years since first enrolling in the level (hereinafter "year"), and previous studies that allowed access to university.

Participants were then asked to specify the number of scientific articles they had read in the previous four months, choosing from six options: none, one or two, three or four, five to seven, eight to ten and more than ten articles. This closed choice was based on previous literature (Alcocer-Vázquez &

Zapata-González, 2018, Larrañaga-Rubio & Yubero, 2005). In addition, scientific reading may be considered irrelevant by respondents, resulting in inaccurate responses to an open-ended question (Schwarz et al., 2008). The decision to include six response options is intended to avoid central tendency response bias (Baka et al., 2012).

Finally, the questionnaire included Hernández-Barrios and Camargo-Uribe's (2017) Spanish adaptation for university students of *the Self-Regulation Strategy Inventory–Self-Report (SRSI-SR)* (Cleary, 2006). The adapted SRSI-SR is a valid measure for assessing students' self-regulation learning strategies, which has already been used in the context of higher education (Hernández-Barrios & Camargo-Uribe, 2017). The tool (appendix A), with an adaptive subscale with three factors (Factor II: Organisation of the environment; Factor III: Information seeking; Factor IV: Task organisation) and a maladaptive subscale with only one factor (Factor I: Inadequate regulation habits), assesses self-regulation strategies for learning. The 18 items are answered on a Likert-type frequency scale (never, rarely, almost always, always). The result of the inventory can be used as an indicator of the general learning self-regulation ability of education students with good reliability indices (FI: inappropriate regulation habits [α = .725]; FII: organisation of the environment [α = .816]; FIII: information seeking [α = .791]; FIV: task organisation [α = .775]; total scale Cronbach's alpha of .81) (Hernández-Barrios & Camargo-Uribe, 2017).

Data analysis

Non-parametric tests for data analysis were performed using the SPSS statistical package (v.29).

SRL scores were calculated on the SRSI-SR scale, adapted from Hernández-Barrios and Camargo-Uribe (2017). A scale of zero to ten points was established for both the total scale score and for the maladaptive (FI) and adaptive (FII, FIII and FIV) subscales in order to conduct a descriptive exploration of the variable.

Average SRL scores were compared according to groups defined by socio-demographic variables. The variables gender (male and female values) and grade (infant & primary education values) were examined using the Mann-Whitney test. The data for the variable year (values: first, second, third and fourth) were analysed using the Kruskall-Wallis test.

As with the previous variable, the range of scientific articles was examined descriptively using contingency tables with the percentages observed for each range of articles read per categorical demographic variable (gender, year and class). The hypothesis of independence of the variables was then tested using Pearson's χ^2 test. The comparison of the range of articles read with the socio-demographic variables was made using the same statistical tests described for the comparison with SRL.

Finally, possible differences in SRL scale scores were examined as a function of the range of scientific articles read by the participants. As this was a comparison of six independent groups (each level of the variable 'range of articles read'), Kruskall-Wallis one-factor ANOVA was used.

To assess the effect size in analyses showing significant differences involving a dichotomous categorical variable that creates two independent groups (gender, grade), the *A* statistics proposed by Vargha et al. was used. (2000). This approach makes it possible to estimate the magnitude of the effect without assuming normal distributions or equality of variances and is characterised by its intuitive interpretation: the closer it is to 1, the greater the effect of the variable under consideration. It should be noted that this *A* statistic corresponds to the *area under the COR curve* provided in the SPSS statistical package (Pardo & San-Martín, 2015). To use this statistic when analyses are significant but involve non-dichotomous categorical variables, *post-hoc* pairwise comparison tests were used to create the dichotomy with that pair.

A correlation test between the variable self-regulation of learning and scientific reading is also included.

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RESULTS

The database containing the original results collected, an extended and expanded analysis of them, and the appendix to this publication can be found in the open science repository Zenodo (https://zenodo.org) at: https://doi.org/10.5281/zenodo.10512218.

Self-regulated learning (SRL)

Table 2 shows the means for the total sample of Bachelor of Teacher Education students for the three possible scores offered by the adapted SRSI-SR scale.

Table 2

Mean SRL factor scores for the sample of N = 1253

Punctuation	Minimum	Maximum	M	DT
Total	2.38	9.38	6.59	.912
Maladaptive subscale (FI)*	.50	7.50	4.5	1.17
Adaptive subscale (FII, FIII, FIV)	2.67	10	7.29	1.029
FII	3	10	8.05	1.169
FIII	2.5	10	6.26	1.52
FIV	2.5	10	7.55	1.474

Note: *FI was converted to its inverse values as it is a maladaptive factor. FI = Inadequate regulatory habits (maladaptive subscale); FII: Organisation of the environment; FIII: Information seeking; FIV = Organisation of the activity; Adaptive subscale = FII, FIII, FIV. M = mean. SD = Standard deviation.

Table 3 shows the descriptive analysis of the socio-demographic variables in relation to the score of each factor and subscale in SRL according to the adapted SRSI-SR instrument.

Table 3.

Descriptive statistics in SRL (adapted SRSI-SR) by socio-demographic variables

	Gender				Grade				Year							
	Male N =304		Female N = 938		Infant education N = 408		Primary education N = 834		Year 1 N = 501		Year 2 N = 370		Year 3 N = 254		Year 4 N = 117	
Punctuation	M	DT	M	DT	M	DT	M	DT	M	DT	M	DT	M	DT	M	DT
Total	6.32	.896	6.68	.902	6.63	.949	6.57	.895	6.59	.878	6.59	.892	6.62	.959	6.5	1.026
Maladaptive subscale	4.64	1.127	4.45	1.181	4.44	1.203	4.52	1.153	4.45	1.178	4.46	1.136	4.57	1.156	4.66	1.261
Adaptive subscale	6.88	1.001	7.42	1.002	7.35	1.073	7.26	1.01	7.31	.976	7.31	1.024	7.31	1.098	7.11	1.111
FII	7.76	1.180	8.15	1.150	8.11	1.235	8.03	1.135	8.1	1.125	8.15	1.139	8.00	1.234	7.75	1.258
FIII	5.98	1.502	6.35	1.514	6.27	1.558	6.26	1.500	6.33	1.444	6.16	1.503	6.26	1.651	6.25	1.577
FIV	6.89	1.470	7.76	1.411	7.69	1.444	7.48	1.483	7.5	1.422	7.62	1.477	7.66	1.484	7.33	1.631

Note: FI = Inadequate regulatory habits (maladaptive subscale); FII: Organisation of the environment; FIII: Information seeking; FIV = Organisation of the activity; Adaptive subscale = FII, FIII, FIV. M = ; SD = Standard deviation.

Significant group differences were found for the gender variable for all scores provided by the adapted SRSI-SR scale. All differences have moderate effect sizes ranging from A = .548 to A = .665 (table 4).

Table 4

Mann-Whitney test between SRL scores (SRSI-SR) and socio-demographic variables

Punctuation	Variable	Mann-Whitney U test	Next	*A*
Total	Gender	109432.500	<.**001**	.616
	Year	163533.000	.266	
Maladaptive subscale	Gender	129019.000	.012	.548
	Year	162734.000	.209	
Adaptive subscale	Yender	99266.000	<.**001**	.652
	Year	159488.000	.073	
FII	Gender	113840.500	<.**001**	.601
	Year	160150.500	.851	
FIII	Gender	123957.500	<.**001**	.565
	Year	169040.000	.851	
FIV	Gender	95505.500	<.**001**	.665
	Year	156619.500	.022	.540

Note: Maladaptive subscale = FI (inappropriate regulatory habits); FII: Organisation of the environment; FIII: Information seeking; FIV = Organisation of the activity; Adaptive subscale = FII, FIII, FIV; Significant results are shown in bold. For significant results, only the effect size (A) was calculated

When the sample was examined for the course variable (table 5), a significant difference was only found for the FII (p = .014). The pairwise comparison shows that this difference is between the first year group and the fourth year group (p = .029) and between the fourth year group and the second year group (p = .011). Both differences show a moderate effect size with values of .586 and .592 for the *A* statistics (table 6).

Table 5

Kruskal-Wallis test (grouping variable: course)

SRL score (SRSI-SR)	M	lf	Next
Total	.668	3	.881
Maladaptive subscale	4.695	3	.196
Adaptive subscale	2.662	3	.447
FII	10.679	3	.014
FIII	2.109	3	.550
FIV	4.345	3	.227

Note: Maladaptive subscale = FI (inappropriate regulatory habits); Adaptive subscale = FII, FIII, FIV; FII: Organisation of the environment; FIII: Information search; IVF = Organisation of the activity

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Table 6

Pairwise comparisons (Mann-Whitney test)

Comparison of years	Test statistics	Next*	*A*
1st - 2nd	-14.328	1.000	
1st - 3rd	27.155	1.000	
1st - 4th	102.746	.029	.586
2nd - 3rd	41.483	.912	
2nd - 4th	117.074	.011	.592
3rd - 4th	75.591	.342	

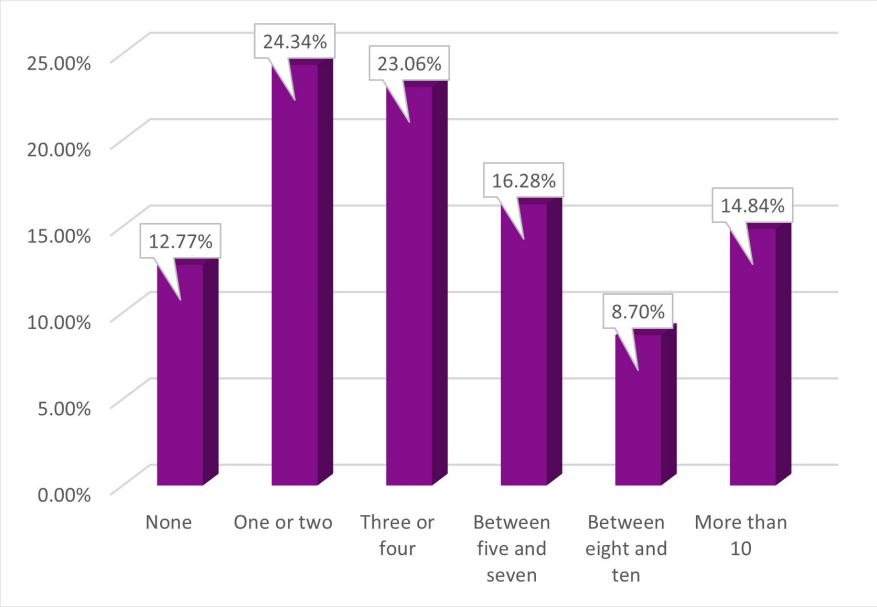
Note: *Significance level adjusted by the Bonferroni correction was used. For significant results, only the effect size (A) was calculated.

Scientific reading in teacher education students

The response percentages found for the variable range of articles read by the sample of prospective teachers were obtained (figure 1).

Figure 1

Percentage response to a variable range of articles read in the last four months



Note: Trend = one or two articles read; Median = three or four articles read; Median = one or two articles read; Median = three or four articles read.

The comparison of the groups generated from the responses to the socio-demographic variables (table 7) does not show significant differences in science reading by grade studied (early childhood vs. primary education) but does show significant differences by gender (p = .015), with a moderate effect size (A = .545) in favour of females. Similarly, the Kruskal-Wallis analysis revealed significant differences in reading range according to the grade studied (p < .001). *Post-hoc* pairwise tests show differences between

first year students and their peers in the next year (p = .000) and between second year students and third year students (p = .000). Both differences have a moderate effect size (table 8).

Table 7

Tests for difference in rank of articles read by socio-demographic variables

Variable	N	Statistics		lf	Next	*A*
		Mann-Whitney U test	Chi-square (Kruskal-Walis)			
Gender	1242	129608.000			.015	.545
Grade	1253	165300.000	--	--	.203	--
Year	1253	--	56.068	3	<.001	

Note: Statistics from two different tests are combined to simplify the presentation of results; empty boxes do not apply to the variable analysed. Only the effect size (A) was calculated for the statistically significant outcome.

Table 8

Post-hoc pairwise comparisons

Comparison of groups	Test statistics	Next*	*A*
3rd - 1st	20.655	1.000	
3rd - 4th	-102.079	.059	
3rd - 2nd	179.174	.000	.645
1st - 4th	-81.424	.150	
1st - 2nd	-158.519	.000	.626
4th - 2nd	77.095	.238	

Note: *Significance values adjusted by Bonferroni correction are used. Only the effect size (A) was calculated for significant comparisons.

Self-regulated learning in relation to the range of articles read

The analysis of the means of the individual subscales of the SRSI-SR shows significant differences in all of them (table 9).

Table 9

Results of the Kruskal-Wallis test between SRL and the number of articles read.

Punctuation	N	Test statistics	lf	Next
Total	1253	54.9128	5	<.001
Maladaptive subscale	1253	26.536	5	<.001
Adaptive subscale	1253	50.896	5	<.001
FII	1253	12.147	5	.033
FIII	1253	47.310	5	<.001

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Punctuation	N	Test statistics	lf	Next
FIV	1253	32.501	5	<.001

Note: Maladaptive subscale = FI (inappropriate regulatory habits); Adaptive subscale = FII, FIII, FIV; FII: Organisation of the environment; FIII: Information search; IVF = Organisation of the activity

The subsequent pairwise comparison shows which reading ranges on each scale of the adapted SRSI-SR instrument show significant differences (table 10).

Table 10

Post-hoc pairwise comparisons

	SRL score (adapted SRSI-SR)																	
	Total			Maladaptive			Adaptive			FII			FIII			FIV		
Comparisons	Stat.	Next	*A*	Stat.	Next	*A*	Stat.	Next	*A*	Stat.	Next	*A*	Stat.	Next	*A*	Stat.	Next	*A*
None – 1-2	-82.173	.300		-47.009	1.000		-77.931	.410		-48.257	1.000		-59.646	1.000		-90.746	.147	
None – 3-4	-157.234	**.000**	.626	-92.447	.134	.574	-152.784	**.000**	.621	-91.371	.146	.572	-140.625	**.001**	.614	-117.553	**.014**	.595
None – 5-7	-172.860	**.000**	.639	-81.595	.469		-175.181	**.000**	.640	-81.032	.486		-177.337	**.000**	.642	-141.671	**.003**	.614
None – 8-10	-179.482	**.001**	.644	-155.934	**.007**	.621	-152.031	**.011**	.625	-71.062	1.000		-136.320	**.031**	.606	-151.562	**.010**	.619
None – > 10	-257.343	**.000**	.697	-167.074	**.000**	.630	-246.397	**.000**	.687	-120.635	**.027**	.593	-217.971	**.000**	.671	-208.525	**.000**	.661
1-2 – 3-4	-75.061	.172		-45.438	1.000		-74.853	.176		-43.114	1.000		-80.980	.085		-26.808	1.000	
1-2 – 5-7	-90.687	.084		-34.585	1.000		-97.250	**.044**	.581	-32.775	1.000		-117.692	**.004**	.594	-50.925	1.000	
1-2 – 8-10	-97.309	.239		-108.925	.098		-74.100	.997		-22.805	1.000		-76.675	.812		-60.817	1.000	
1-2 – > 10	-175.171	**.000**	.639	-120-065	**.005**	.597	-168.466	**.000**	.632	-72.378	.451		-158.325	**.000**	.625	-117.779	**.007**	.593
3-4 – 5-7	-15.626	1.000		10.852	1.000		-22.397	1.000		10.339	1.000		-36.712	1.000		-24.118	1.000	
3-4 – 8-10	-22.248	1.000		-63.487	1.000		.753	1.000		20.309	1.000		4.305	1.000		-34.009	1.000	
3-4 – > 10	-100.110	**.049**	.582	-74.627	.404		-93.613	.089		-29.264	1.000		-77.345	.317		-90.971	.108	
5-7 – 8-10	-6.622	1.000		-74.339	1.000		23.150	1.000		9.970	1.000		41.017	1.000		-9.891	1.000	
5-7 – > 10	-84.483	.319		-85.480	.281		-71.216	.783		-39.603	1.000		-40.634	1.000		-66.854	1.000	
8-10 – > 10	-77.861	1.000		-11.140	1.000		-94.366	.459		-49.574	1.000		-81.650	.867		-56.962	1.000	

Note: Statistics = Test statistics for pairwise comparisons; Next = Significance values adjusted by Bonferroni correction are used.; Only the effect size (A) was calculated for significant comparisons. Significant results are shown in bold.

DISCUSSION

The present study focused data collection on two main variables: self-regulated learning skills (SRL) and the reading of academic articles and texts by university students preparing to become teachers.

Self-regulated learning (SRL)

In the context of the first proposed objective, the assessment of SRL in Infant or Primary Education teacher students, the scores on the adapted SRSI-SR instrument range from six to eight on a scale of zero to ten, reflecting medium to high scores. The maladaptive subscale shows lower scores that do not reach the pass mark. The total score is slightly lower than the previous validation by Hernández-Barrios and Camargo-Uribe (2017), with an average of 4.5 compared to 5.4 previously recorded. However, in the organisation of the environment factor (FII), the current study shows an average of 8.05, exceeding the 6.9

of Hernández-Barrios and Camargo-Uribe (2017). Repeat study, a factor present in the previous study, was not considered, which may explain some of the differences found in the sample.

The trainee teachers surveyed show excellent performance on the adaptive subscale and good environmental and task organisation strategies. However, their inadequate habits for self-regulation of learning result in a lower overall SRL score than described by the data of Hernández-Barrios and Camargo-Uribe (2017). Students surveyed need to improve their understanding of complex topics, ask their teachers when they don't understand something and avoid distractions while studying to improve their overall SRL scores.

On all SRL scores with the SRSI-SR scale, female students significantly outperform their male peers. The findings are consistent with previous research highlighting the superior ability of female student teachers to manage their own learning (Baldan-Babayigit & Guven, 2020; Larruzea-Urkixo & Cardeñoso-Ramírez, 2020). At the overall SRL level, similar to previous research (Larruzea-Urkixo & Cardeñoso-Ramírez, 2020), there are no differences between infant and primary education, although in detail the sample studied shows a significant difference in the organisation of the task, with infant students performing slightly better than primary students.

Differences in self-regulation of learning between students in different years of the Bachelor of Education programme are minimal in this study. Fourth year students show significantly less organisation of the learning environment than first and second year students. These findings contradict previous literature suggesting better self-regulated learning scores for students in their final years of undergraduate study (Baldan-Babayigit & Guven, 2020; Severini et al., 2020). This discrepancy could be due to differences in the sample sizes of the courses analysed, with final year students accounting for the smallest proportion of participants.

Scientific reading in teacher education students

The second objective was to examine the readership profile of university students in scientific publications. Both men and women tend to have read one or two articles. In terms of studies, students of Infant Education teacher are more likely to have read three or four articles, while primary students are more likely to have read one or two. Regarding Masters' students, only the first year students mainly choose the option 'one or two items', while in the following three years the preference shifts to three or four items.

There are no differences in science reading between infant and primary education teacher students. However, there are significant gender differences in student teachers, with a moderate effect in favour of women. According to previous literature, university students have limited time to read, which makes it difficult to consolidate a reading habit. They prefer to read literary or self-help texts rather than scientific texts related to their education. In this sense, their contact with informative texts is reduced to those that are compulsory and essential to pass the subjects in the curriculum, using the reading of informative texts as an instrument (Alcocer-Vázquez & Zapata-González, 2021; García-Gutiérrez et al., 2019; Granado & Puig, 2014). A study conducted at the University of Delhi (India) found that social science students tend to read for academic purposes, compared to technology students who seek to acquire more knowledge (Khatri, 2021).

Another important finding of this study is that students read less during the first four months of the first year of these programmes, with most students choosing not to read any articles at all. This finding is consistent with the underdeveloped reading habit described by Cardona-Puello et al. (2018) among incoming students in various Colombian university programmes. The data also show that - comparatively - more reading takes place in the second year than in the first and third year, so it cannot be said that there is an increase in the scholarly reading profile of prospective teachers towards the end of their initial training.

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Self-regulated learning in relation to scientific reading in trainee teachers

The final research objective was to investigate whether there were differences in self-regulated learning according to the range of scientific articles read over a four-month period. The data confirm significant differences on all scales of the adapted SRSI-SR questionnaire. The mean scores for the SRL, the Adaptive Scale, and the information search and organisation of the activity factors have worse mean scores in the 'no articles' range compared to all other options except 'one or two articles' read per semester. The largest effect is found when comparing those who read no articles with those who read more than ten. In general, the ability to self-regulate learning improves with increased scientific reading. There are no significant differences between those who read no articles and those who read one or two, with improvements found from three articles per semester.

Although there are mixed results in the literature on the relationship between SRL and academic performance (García-Pérez et al., 2021; Larrueza-Urkixo & Cardeñoso-Ramírez, 2020), the data from this study confirm that reading scientific articles can explain the improvement in SRL scores of the sample of prospective teachers analysed. In fact, the lack of academic reading habits in the data collected correlates with a low level of SRL skill development, which negatively affects the ability to engage in critical reading and thus the development of critical thinking in university students.

Encouraging the practice of academic reading has been suggested to improve the SEL performance of future teachers (Afdal et al., 2022; García-Gutiérrez et al., 2019), as reading scientific articles is important for academic success and the ability to read these types of texts improves with practice and continued exposure (Hubbard & Dunbar, 2017).

CONCLUSIONS

This research highlights that increasing scientific reading in infant and primary education teacher students can improve their self-regulated learning skills, which contributes to the development of critical thinking (Alcocer-Vázquez & Zapata-González, 2021; Caride et al., 2018). It emphasises the importance of an approach that promotes students' choices in reading, integrating intrinsic motivation to foster multiple skills and competences (García-Pérez et al., 2021; Wise, 2021).

The positive relationship between science reading comprehension performance and executive function, analogical reasoning, and positive attitudes towards reading is supported by evidence (Hsu et al., 2019; Bizama-Muñoz et al., 2020). It is proposed to replicate studies using eye tracking in Spanish students to assess the relationship between visual behaviour and cognitive structures, applying neurodidactic strategies (Wang et al., 2020; Muchiut et al., 2018).

The influence of teachers' reading habits on their teaching practice highlights the need for active and critical teachers to promote the importance of reading as a tool for learning (Afdal et al., 20-22; Granado & Puig, 2014). Adapting scientific texts and using group readings and infographics can make it easier to teach scientific content (Becerra-Rodríguez et al., 2021).

It is suggested that future research should focus on the didactic use of science reading adapted to schoolchildren in order to prevent preconceived ideas and foster a passion for science. Limitations such as the representativeness of the sample or the individual and exclusively quantitative focus of the study suggest directions for future research to overcome these limitations. A relational approach with self-reported measures of scientific reading and assessment of SRL before and after specific educational interventions is recommended.

In conclusion, despite the challenges in educational research, the findings provide an opportunity to promote scientific reading and evidence-based teaching models to improve the self-regulated learning skills of future teachers (Perines, 2018).

AUTHORS' CONTRIBUTIONS

Marta Torrijos-Muelas: Formal Analysis; Data curation; Writing – original draft; Writing – review & editing; Investigation; Methodology; Software; Validation; Visualization.

Sixto González-Villora: Conceptualization; Writing – review & editing; Investigation; Supervision; Validation.

Ana-Rosa Bodoque-Osma: Project administration; Writing – original draft; Investigation; Resources; Supervision.

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APPENDIX A

Sample of participation survey

This model is an approximation of the digital survey used to collect data for the study it accompanies. Some features of the questions and answers may not be accurate because the digital format used cannot be reproduced on paper.

I declare that I have read the "Participant Information Sheet" and agree to take part in the study.

I have access to the "Participant Information Sheet" and "Informed Consent". The characteristics and purpose of the study and the potential benefits and risks of my participation have been explained to me.

I was able to ask questions in good time and they were all answered to my satisfaction.

I have been assured of the confidentiality of my data.

I give my consent voluntarily and understand that I am free to withdraw from the study at any time without prejudice.

To give your consent and start your participation, click on "YES".

To withdraw your consent and end your participation, click on "NO".

Socio-demographic data

Age: _____.

What are you currently studying? _____

In which year did you first enrol in this degree? _____

Gender you identify with:

Female / Male / Prefer not to answer / Other (specify)

From what studies did you enter university?

Baccalaureate of Arts

Baccalaureate of science, health sciences option

Bachelor of science, technology option

Baccalaureate in the humanities

Baccalaureate in social sciences

How many scientific or magazine articles did you read last semester?

None

1 - 2

3 - 4

5 - 7

8 - 10

> 10

For the following statements, choose the answer that best fits your reality. Remember that there are no right or wrong answers, only your own perception of yourself and the frequency with which you perform the suggested actions.

		Factor*	Never	Almost never	Almost always	Always
1	I make sure that no one distracts me when I am studying.	FII				
2	I avoid asking questions in class if I do not understand the subject.	FI				
3	I use a method to keep my teaching materials in order.	FIV				
4	If I do not understand something, I ask the teachera.	FI				
5	I carry out additional literature searches to help me understand class topics.	FIII				
6	I plan the order in which I will carry out my academic activities.	FIV				
7	I give up easily when I do not understand something.	FI				
8	I coordinate my time according to the academic activities assigned to me.	FIV				
9	I make a timetable to organise my study time.	FIV				
10	Before I start studying, I think about the best way to do it.	FIV				
11	I finish all my academic activities before I start other activities.	FII				
12	I do research when I do not understand something about the tasks I am given.	FIII				
13	When I study, I ignore subjects that are difficult to understand.	FI				
14	I try to study in a place without distractions (noise, people talking…).	FII				
15	I am easily distracted when studying.	FI				
16	I am looking for material to supplement the topics covered in class.	FIII				
17	I try to study in a quiet place.	FII				
18	I allow people to interrupt me when I am studyinga.	FII				

Note: a = reverse item in your score.

* The factor to which each item belongs is added here, but the information in this column was not given to the participants when they completed the questionnaire. FI = Factor I; FII = Factor II; FIII = Factor III; FIV = Factor IV. Factor I forms the maladaptive scale, while the other three are agglomerated and correspond to the adaptive scale of the questionnaire.

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