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RECEIVED 29 September 2024

ACCEPTED 07 March 2025

PUBLISHED 24 March 2025

CITATION

Matulaitienė J, Kaminskienė L,
Monkevičienė O and Lehtinen E (2025)
Teacher- and student-related factors
supporting primary school students'
self-regulated learning.
Front. Educ. 10:1503867.
doi: 10.3389/feduc.2025.1503867

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Teacher- and student-related factors supporting primary school students' self-regulated learning

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This study investigates how teachers' strategies and learners' behavior contribute to the development of self-regulated skills (SRL) in primary education. The development of SRL in this level of education is not well investigated, yet SRL skills are important indicators of students' success in later years of their studies. The study responds to the scientific and practical problem related to the fact that teachers are not sufficiently familiar with the teaching of SRL in the classroom. The article is based on the data gained from self-reported questionnaires on SRL development for fourth graders ($n = 253$) and their class teachers ($n = 16$) in Lithuania. Multiple regression analysis was used to analyse the survey data and to identify the interaction relationships between the participants. Four main predictors of the development of SRL skills in primary education were identified including teachers' attitudes toward teaching, teachers' support strategies for students, learning environment and students' perceived teacher support. The results indicate that students' perceived teacher support and learning situations modeled by teachers through the learning environment significantly impact the development of SRL skills in primary education.

KEYWORDS

self-regulated learning development, primary education, learning environment, teachers' support, teachers' attitudes

Introduction

Students spend countless hours at school not only pursuing new knowledge or abilities but also learning to learn—that is, learning to systematically govern their thoughts, feelings and actions to achieve an academic goal (Zeidner and Stoeger, 2019). This process is called “self-regulated learning (SRL). SRL is a multidimensional construct that links cognitive, metacognitive, behavioral and affective–motivational content related to academic learning (Panadero, 2017). Particularly in primary education, developing self-regulation in students is challenged by the impacts of different instructional strategies (Vandeveldt et al., 2016). SRL skills are important indicators of student success (Donatella et al., 2023), but many students encounter difficulties in self-regulation. It has been extensively investigated (Donatella et al., 2023; Karlen et al., 2021; Schunk and Greene, 2018). For example, the development of SRL skills has been analyzed in different teaching and learning contexts, but research recommendations for further analyses emphasize that the results are not always transferable to educational solutions (Tzimas and Demetriadis, 2024). Nevertheless, another study has found in classroom settings, SRL can be better developed

and supported by teachers (Callan et al., 2022). When teachers' guided instructions and consistent reminders regarding self-regulation processes are combined with subject-specific strategies during lessons, students easily utilize SRL skills in multiple subjects (Dignath and Veenman, 2021). According to Cleary and Zimmerman (2004), helping students to become self-regulated learners means assisting them in acquiring the necessary skills and structuring their environment to facilitate their practice of and engagement in SRL. However, recent studies on teaching and learning have shown that only a fraction of students understand the learning process through the learning environment (LEN) created by their teacher (Muijs and Bokhove, 2020). Even if the LEN and the process are very well designed, they are not effective for the other learners without differentiated instructional strategies, as the content remains uncomprehended and unlearned (Xu et al., 2024). Thus, the development of self-regulation skills requires not only a LEN designed by the teacher but also a LEN that is inclusive, that reaches out to each student and that is personalized.

In Lithuania, there have been positive developments in improving the performance of primary school students, but the average quality of teaching is still not good, according to an external evaluation of schools (National Reforms in School Education, 2022). It has been pointed out that primary schools in the country should promote students' active learning more vigorously. In fact, as already mentioned, direct and indirect SRL has been recognized as an important school survival tool for students at all educational levels (Bjork et al., 2013). The aim of the study was to identify different student and teacher related factors that contribute to the development of students' SRL in primary school classrooms.

Development of self-regulated learning skills in primary education

Learning to learn among students starts in primary school, so it is important for teachers to focus on learning to learn earliest and to introduce their students to relevant learning strategies, as well as to how to apply them in their learning. Primary school lays important foundations for pupils' further learning in other stages, which obliges educators to reflect on the effectiveness of their approach to learning to learn, and to change it and even reconstruct the educational process if needed. Primary schools are aware of what and how their students need to learn but lack the knowledge and skills for better regulating their students' learning. Teachers, in particular, play a crucial role in students' SRL development, as SRL skills are not part of the natural maturation process and, thus, do not develop automatically but gradually develop as a child grows (Babiera and Quirap, 2024; Stoeger et al., 2014).

Previous studies have emphasized the need to support students' SRL development from an early age (Dignath and Büttner, 2008; Montroy et al., 2016), as students develop the ability to organize their learning during the primary school years (Lombaerts et al., 2009). According to Schunk and Zimmerman (2013), SRL can be successfully developed in the first years of primary school. Students need to be given sufficient time and opportunity to develop SRL skills that enable them to learn at deeper level and to adapt to

different learning strategies in later grades. Younger students seem to be especially susceptible to SRL instruction, as they are still beginning to develop learning and self-efficacy beliefs, and thus, ineffective learning strategies may not yet be fully established in them (Montroy et al., 2016). SRL has been shown to be a key concept in explaining students' persistence, initiative, and adaptive capacity (Zalazar-Jaime and Medrano, 2020). The ability to adapt that is a particularly important factor in the transition from primary to secondary school. However, the lack of focus on SRL in primary education, and during the transition period, presents students with learning challenges that they often lack the skills to overcome (Barber et al., 2011; Chaves-Barboza et al., 2017).

An engaging and motivating LEN is important for SRL across all subjects and all grades (Hafizoglu and Yerdelen, 2019). Learning action in the classroom environment has a crucial role in promoting students' self-regulation of their thoughts, feelings and actions (Sabourin et al., 2013). For example, researchers have found that self-regulated learners are more likely to seek out information (De Bruin et al., 2011) and advice (Clarebout et al., 2010). However, the learning environment must be appropriate to the students' development levels and must meet their needs (Kolovelonis et al., 2012). The LEN is directly and indirectly created and modeled in classrooms by teachers who must rise to the challenge of finding the right methods and strategies for creating and nurturing an inclusive LEN in primary education. Self-regulated learners have been found to expect more from their teachers than from their classmates and other participants in the LEN (Mulang, 2021). These highlight the role of the teacher in education and open up opportunities for them to develop their students' SRL abilities. However, there has been a lack of research on students' perceptions of a learning environment that would be conducive to their development of SRL.

TS, in particular, play a crucial role in students' SRL development, as SRL skills are not part of the natural maturation process and, thus, do not develop automatically but gradually develop as a child grows (Babiera and Quirap, 2024; Stoeger et al., 2014). Thus, it is important for teachers to focus on SRL development earliest and to introduce their students to relevant learning strategies, as well as to how to apply them in their learning. This obliges them to reflect on the effectiveness of their approach to learning to learn, and to change it and even reconstruct the educational process if needed. Schunk and Greene's (2018) analysis of SRL models suggested that to promote students' SRL, teachers consider students' beliefs about learning, emotion (Butler and Cartier, 2018), motivation (Vosniadou et al., 2024), cognition (Tsarava et al., 2022), metacognition (Bjork et al., 2013), the LEN (Vandeveldt et al., 2016) and social interaction (Järvelä et al., 2023). On the other hand, Ryan and Patrick (2001) found that students who perceive their teachers as supportive are more confident, active and continuously engaged in learning. Schunk and Greene's (2018) analysis of SRL models further found that students perceive their teachers' support through the following: the teacher's teaching strategies (Van Rens and Groot, 2023), teaching approach (Bru et al., 2010) and the classroom environment as general atmosphere (Ryan and Patrick, 2001).

Teacher support strategies (TS) in learning are important resources in the learning process, because they respond to students' need for their teachers' encouragement, support and useful

guidance (Xu et al., 2023). According to the self-determination theory (Ryan and Patrick, 2001), interpersonal relationships enhance students' intrinsic learning motivation, and students who believe their teachers support them are more engaged in their studies. Student engagement is an important indicator of the quality of students' learning process (Babiera and Quirap, 2024), which is influenced by internal and external factors, such as learning support and learning drive. Research has found that teachers' support was associated with satisfaction of students' basic psychological needs, which predicted self-regulation (Xu et al., 2023). Moreover, self-regulated learners have been found to pursue positive learning climates (Labuhn et al., 2010), and positive relationships between them and their teachers have been revealed as characterizing a LEN that promotes student success (Deci and Ryan, 2002; Eccles et al., 1997).

One of the interests in this study was TAT toward learning and the strategies teachers use to support student learning in the teaching process and help to develop the learning skills. While various studies have shown that the value of self-regulation in the learning process is undeniable, teachers still have limited understanding of self-regulated teaching and learning and can only rarely select and apply teaching strategies that promote more autonomous learning (Alvi and Gillies, 2021). Concerns about teachers' knowledge about SRL education have been evident in research (Dignath and Sprenger, 2020; Lawson et al., 2019). Therefore, the limited recognition of the SRL concept poses a significant challenge to teachers' attitudes (TAT) toward its promotion. One of the most exhilarating experiences a teacher can have is leading a class of enthusiastic, engaged students. However, in order to achieve this, students need relevant skills and appropriate support from teachers (Lawson et al., 2019). The types of tasks that teachers choose and assign to their students during lessons and homework have a direct impact on the nature of student learning (Karlen et al., 2020). Instructional tasks are an important part of the teacher's agency to influence SRL and represent a significant portion of the teacher's influence during a lesson (Karlen et al., 2020). Lesson tasks are a key part of the agency exercised by the teacher to influence SRL and constitute a substantial part of the influence exerted by the teacher during a lesson (Karlen et al., 2020). With a clear and precise TAT for SRL, teachers can share knowledge with their students by explaining them SRL strategies and the differences between self-regulated and non-self-regulated learning, to enrich their understanding of how students perceive particular learning contexts and how these perceptions influence their beliefs about themselves as learners, their goals, expectations and the choices they make about how to regulate their own learning process (Butler and Cartier, 2018; Wan et al., 2021). Therefore, to support this knowledge construction teachers need good quality knowledge about strategies for the SRL, so they could promote these strategies in their lessons (Kramarski and Kohen, 2017). The effective use of these strategies has been shown to have significant effects on student achievement (Schunk and Greene, 2018; Lawson et al., 2019).

Research also suggests that teacher support is important in the process of SRL development (Xu et al., 2023) and particularly in primary education (Karabenick and Newman, 2006). Studies

suggest that students perceive teacher support (SPTS) through variety of ways:

- *Teaching methods*—which is reflected in the students' active involvement in completing the task, reflection on newly discovered knowledge, and sharing of experiences about why students need it (Van Rens and Groot, 2023).
- *Classroom environment*—the general atmosphere of the classroom, including the structure, organization and emotional climate, communication and cooperation between student promotion set by the teacher (Zhang and Li, 2023).
- *Teaching approach*—the way teachers interact with students, such as emphasizing personal relationships, providing clear instructions, and offering academic guidance (Bru et al., 2010).
- *Subject matter and instruction*—how teachers explain and teach subjects, the level of engagement in classroom activities, and the relevance of the curriculum to students' interests (Saville et al., 2023).

Research on SPTS for students has primarily focused on instruction or academic support (Pianta et al., 2003). Students who perceive their teachers as supportive are more confident, active, and more continuously engaged in learning (Glogger-Frey et al., 2018a,b).

Moreover, the relationship between perceived teacher support, student engagement, satisfaction of basic psychological needs and SRL requires further research. Thus, this study investigates teachers' attitudes toward learning and the strategies they use to support student learning in the teaching process and that help develop students' learning skills. The types of tasks that teachers choose and assign to their students during lessons and for homework directly impact the nature of their students' learning (Donatella et al., 2023). Each of these components is crucial and works together to create an environment where SRL is not just taught but deeply embedded in everyday learning. Thus, the teaching of SRL and content are intertwined (Karlen et al., 2023). Based on the above said, this study raises the following research questions:

1. Which teacher-related factors contribute to the development of self-regulated skills?

In order to answer the first research question, two hypothesis (H1 and H2) were formulated:

H1: *Teachers' attitudes toward teaching (TAT)* is statistically significant predictor of students' SRL skills.

H2: *Teachers' support strategies for students (TS)* is a statistically significant predictor of students' SRL skills.

2. Which student-related factors contribute to the development of self-regulated skills?

Two more hypothesis (H3 and H4) were formulated to answer the second research question.

H3: *Students' perceived learning environment (LEN)* is a statistically significant predictor of students' SRL skills.

H4: *Students' perceived teacher support (SPTS)* is a statistically significant predictor of students' SRL skills.

Methodology

Research design

The study is based on cross-level survey (Walter et al., 2013) and it applies different data sources for triangulation (Mukumbang, 2023). Quantitative self-report data was collected from primary school teachers and their students. Students' SRL was predicted by their own self-reports of various aspects of their studying and by their teachers' self-reports of various aspects of their teaching and relationship to students.

Participants and procedure

To explore a range of perspectives, this study was carried out with five Kaunas city primary schools fourth-grade students aged 9–10 years to explore the development of SRL skills among primary school learners and with the teachers of those classes to explore their attitudes and practices toward students' SRL skills development. The fourth grade teachers who have the most weekly lessons (classroom teachers) were purposively selected for the study.

After permission to conduct this study was obtained from the Vytautas Magnus University's Ethics Committee, convenience sampling was used to select primary schools. Primary schools in Kaunas city, one of Lithuania's largest cities, were selected due to their high academic performance. This selection criterion was used based on the assumption that schools demonstrating higher academic performance may have more practices in SLR development. The research participants were 253 fourth-grade students and 16 teachers. All students and teachers who gave consent to participate in the study were included. As the Lithuanian Data Inspectorate requires the written informed consent of the parents of children younger than 16 years for their children to participate in a study, the students' parents were sent a written description of the project and asked to give such written consent. The teachers' written consent to participate in this study was also secured.

Tables 1, 2 show the sociodemographic characteristics of the participants.

The data show that almost all of the study participants were 9-year-olds but that the gender distribution was fairly balanced.

The demographic data of teacher participants show that all of them were female. This situation reflects a gender distribution of Lithuanian teachers. According to the Lietuvos statistikos

TABLE 2 Demographic data of the teachers who participated in this study (N = 16).

Demographic data		n	Percentage
Age (in years)	25–35	1	6.2
	36–45	2	12.5
	46–55	6	37.5
	56–65	7	43.8
Gender	Men	0	0
	Women	16	100
Length of teaching experience (in years)	1–10	2	11.8
	11–20	1	5.9
	21–30	3	17.7
	31–40	7	53.1
	41–50	3	17.7
Professional qualifications	Teacher	3	18.8
	Method teacher	13	81.3
	Expert teacher	0	0

departamentas (2024), 27.3 thousand teachers and school leaders worked in Lithuanian general education schools in 2023. Women teachers accounted for 88.3% of all teachers, while men teachers accounted for 11.7% of all teachers. However, they had different ages and lengths of teaching experience, although most of them were older (46–65 years old) and had more than 31 years of experience. Moreover, in our study most of them were teachers or methodist teachers. In Lithuania, teachers have qualifications that indicate their different levels of expertise based on their qualifications, work experience and professional achievements. There are three formal qualification categories:

1. Teacher—a teacher who has a higher education qualification (usually a bachelor's degree) but has not yet reached a higher level of qualification.
2. Methodist teacher—a teacher who has some work experience and has completed the required in-service training. Such a teacher has more experience and often takes on additional responsibilities, such as overseeing methodological activities and helping other teachers to improve teaching methods and processes.
3. An expert teacher is a teacher who has reached the highest level of qualification and has a high level of professional experience and recognition (Pedagogu kvalifikacijos tobulinimo koncepcija, 2012).

Instrument

To investigate the factors driving the development of SRL in primary education, we used two closed-ended questionnaires to address our research questions, targeting teachers and primary school students. The pupils' questionnaire was designed to take

TABLE 1 Demographic data of the students who participated in this study (N = 253).

Demographic data		n	Percentage
Age (years)	9 y	223	87.8
	10 y	29	11.5
	11 y	1	0.4
Gender	Boys	118	46.6
	Girls	135	53.4

no more than 20 min to complete, and the teachers' questionnaire—15 min.

The student questionnaire consisted of a total of 28 statements divided into four subscales: required learning skills of students, seven statements; on learning environment, seven statements; collaboration with teacher, nine statements; on students perceived teacher support, five statements. The structure of student questionnaire:

1. *Required learning skills of students*—consisting of questions to assess student information-seeking task, managing learning challenges and help-seeking strategies, learning planning, goal setting and goal-achievement skills (Vandeveldt et al., 2016; Donatella et al., 2023; Karlen et al., 2021; Panadero et al., 2021; Schunk and Greene, 2018). A sample item is: “I know that learning ways can be different.”
2. *The learning environment* components were measured through the choice, use and accessibility of learning tools and instruments, the learning atmosphere in the classroom, teacher help (Hafizoglu and Yerdelen, 2019; Baric et al., 2023; Mulang, 2021). A sample item is: “We learn interesting things during lessons.”
3. *Collaboration with teacher*—analyzed through teacher's demands for learning, praise, encouragement and reinforcement for learning, recognizable teacher's advice and learning help (Stoeger et al., 2014; Karlen et al., 2023). A sample item is: “The teacher encourages the pursuit of new my learning goals.”
4. *Students perceived teacher support*—the scales measuring in what ways students perceive teachers offer their help, in what kind of tasks allow students to try new ways of learning, what encouraging measures are used (Ryan and Patrick, 2001; Saville et al., 2023; Xu et al., 2023). A sample item is: “The teacher gives me advice on how to complete different tasks.”

The teachers' questionnaire had a total of 24 statements divided into three subscales: 11 statements, on their learning attitudes and initiated activities; seven, on their teaching environment; six, on their collaborative teaching process with students. The responses corresponded to a 5-point Likert scale. The structure of teacher questionnaire:

1. *Teacher's learning attitudes during initiated activities*—assessing statements about the educational process being based on metacognitive teaching strategies, familiarizing students with the learning strategies they receive, and the search for forms of teacher-student collaboration that encourage self-regulated learning (Hiebert and Wearne, 1993; Alvi and Gillies, 2021). A sample item is: “It is important that the educational process is based on self-regulatory learning strategies.”
2. *Teacher support for learning*—analyzed through innovations in learning, discussing the roles and responsibilities of the teacher and pupils, linking learning to hobbies and personal interests (Sankalaite et al., 2021; Brenner, 2022). A sample item is: “During lessons, I pay attention to the learning strategies used by students, giving them opportunities to reflect on them.”

3. *A collaborative teaching process with students*—analyzed through discussions and roles in the lessons, the changing roles of teacher and student in the classroom (Stoeger et al., 2014; Panadero, 2017). A sample item is: “I help make decisions about changes in learning strategy based on students' reflections.”

Measures

The data were collected at schools at a prescheduled and agreed-upon time. The data were collected between January 2023 and April 2023. To collect such data, two questionnaires—one for students and the other, for teachers—were prepared.

Cronbach's α test was used to determine the internal consistency of the statements, with a Cronbach's α value >0.7 indicating sufficient internal consistency (Bujang et al., 2018; Fornell and Larcker, 1981). Five subscales were used: three for the students (LEN, Cronbach's $\alpha = 0.0725$; SPTS, Cronbach's $\alpha = 0.842$; and SRL, Cronbach's $\alpha = 0.795$) and two for the teachers (TAT, Cronbach's $\alpha = 0.862$ and TS, Cronbach's $\alpha = 0.956$). All the statements in the five subscales were found to have sufficient internal consistency.

Data analysis

Multiple regression analysis was used to analyse the survey data and to identify the interaction relationships between the participants. To analyse the learning situations created by the teachers to promote the students' SRL and the learning situations experienced by the students, two types of factors were analyzed for each (Figure 1).

All of the data analyses were performed using IBM SPSS 25. In such analyses, the sums of the variables of the subscales were used. The means, standard deviations and Pearson correlations were analyzed as descriptives. In the correlation and regression

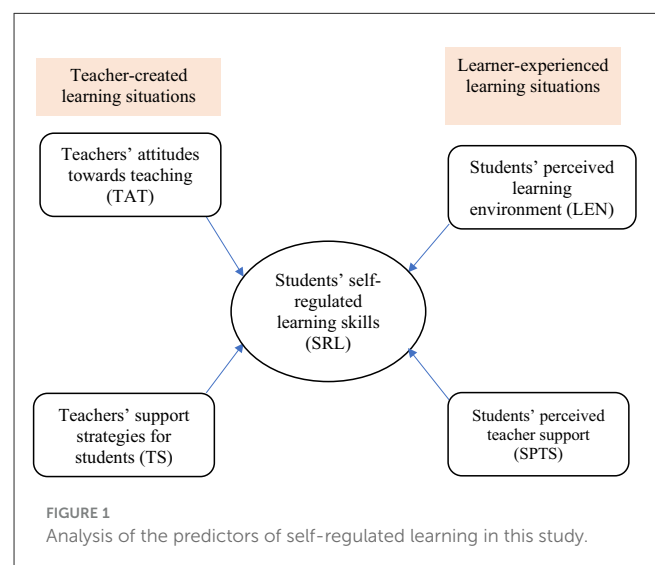


TABLE 3 Descriptive statistics and correlations between the regressors (study variables; pearson correlation; $N = 253$).

	C	M	SD	1	2	3	4	5
1	Development of self-regulated learning skills in primary education (SRL)	7.9	0.9	–	0.069	0.102	0.327**	0.340**
2	Teachers' attitudes toward support for self-regulated learning (TAT)	4.5	0.4		–	0.539**	–0.017	0.124
3	Teachers' support strategies for students (TS)	4.1	0.3			–	–0.020	0.111
4	Students' perceived teacher support (SPTS)	7.7	1.3				–	0.446**
5	Learning environment (LEN)	7.5	1.1					–

**Correlation is significant at the 0.01 level (2-tailed).

TABLE 4 Results of the regression analysis ($N = 253$).

Model		Unstandardized coefficients		Standardized coefficients beta		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.824	0.824	–	5.857	<0.001
	TAT	0.030	0.178	0.012	0.166	0.868
	TS	0.173	0.185	0.068	0.936	0.350
	SPTS	0.153	0.045	0.234	3.399	<0.001
	LEN	0.143	0.052	0.197	2.837	<0.001

Dependent Variable: SRL.

analyses, the same value of teacher variables (two teacher variables) was connected to variables of each student (two students variables) from the same classroom.

data are nested, we analyzed whether the residuals were dependent on the different teachers. There were some teacher-dependent differences in the residuals, which means that the results should be interpreted with caution.

Results

The descriptive statistics for the regressors (i.e., the study variables) are presented in Table 3.

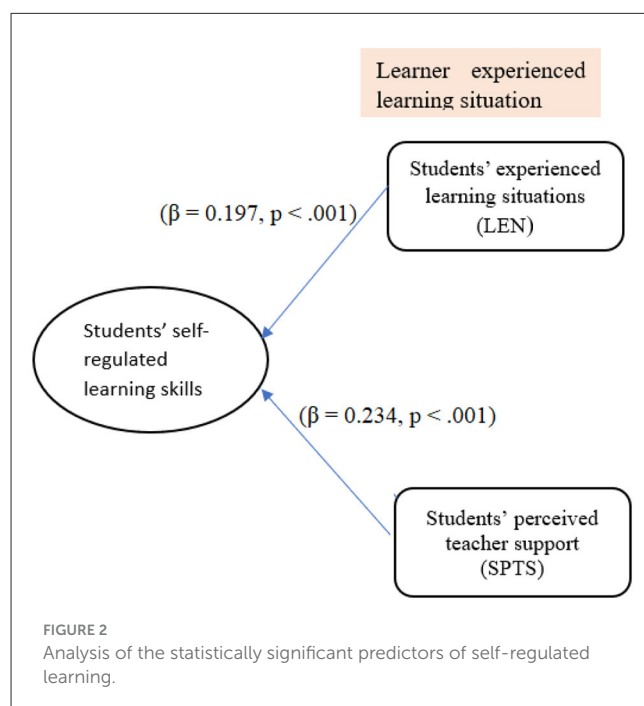
The skewness values were all between -0.238 and -0.525 . The kurtosis values were all between -0.806 and 0.981 , which shows that all the variables were normally distributed. Positive moderate correlations were found between SRL and SPTS and between SRL and LEN. Prediction models were built using multiple linear regression. Regression analysis was carried out with TAT, TS, LEN and SPTS as the independent variables, and the students' SRL as the dependent variable. All of the independent variables were linearly related to the dependent variable, and there was no multicollinearity between the variables (all of the Variance inflation factor values were between 1.025 and 1.419). Table 4 presents the results of the regression analysis.

The model showed that only the student variables, SPTS and LEN, were significant predictors of SRL, with SPTS as the strongest predictor (Figure 2). This means that the pupils with more pronounced SPTS and LEN reported stronger SRL. The R -squared was 0.143, meaning that the model explained about 40% variations of the SRL variable. According to Analysis of Variance, this overall model was significant: $F_{(4,228)} = 9.51$ and $p < 0.001$. TAT and TS were not significant predictors in the model.

SPTS and LEN the standardized residual errors (residuals) the graphs show that the assumptions of heteroskedasticity of normality were satisfied. The Durbin-Watson test showed no autocorrelation among the residuals ($d = 1.7$). To test whether the data are heteroskedastic, a scatterplot was used. There were no unequal variances over a range of measured values. Because the

Discussion

Our findings show that SRL is affected by SPTS and LEN. Surprisingly, the results also show that TAT and TS that are directly



aimed at supporting SRL do not have a statistically significant relationship in promoting students' self-regulation of learning. This means that the more motivated students are by LEN and the more they perceive TS, more self-regulated they are expected to be in their learning (Baric et al., 2023; Mulang, 2021). This finding is supported by some previous studies in which a relationship between LEN and SPTS was reported (Harks et al., 2013; Rakoczy et al., 2019).

Therefore, in addition to understanding strategies, students need guidance on when and how to apply them, recognize their relevance in successful learning, and be actively encouraged to use them (Hertel and Karlen, 2021; Pintrich and Zusho, 2002). One possible reason for such findings is that students who perceive and experience their teachers' support in the learning process are likely to be more willing to be actively involved in the learning process and to search for new learning strategies, which can result in a higher level of learning satisfaction and motivation. In addition, in such situations, students are expected to feel free to provide and accept new learning strategies, which can lead to effective learning and new personal discoveries about their own learning (Zalazar-Jaime and Medrano, 2020).

To further substantiate the significant predictors of SRL revealed by the regression analysis, that is, SPTS and LEN. The results of this study were examined via descriptive analysis to allow us to discuss and contribute to the development of new forms of teacher support for student learning and for the creation of engaging learning environments that promote SRL. Sutrisno (2020) argued that confidence in one's own learning is an important life skill that can go beyond the classroom, as it helps learners to see failures and defeats not as indicative of inadequacies but rather, of the potential to grow and improve. A positive response from the teacher to students' mistakes can encourage students to be more confident in repeating tasks and to look for the right answer or the right way to do the task themselves (Pöysä et al., 2018; Zorn and Puustinen, 2022). In other words, not by giving a bad mark or a remark, but by modeling the content of the lesson so that more time can be devoted to different ways of learning, discussing and exploring different ways of learning—encourages students to have confidence in their own learning. And the results of this study confirm that a teacher-constructed LEN with SPTS in which students have confidence in their learning is an important predictor of SRL. This finding supports the results of new perspectives on the benefits of teacher support (Chang and Bangsri, 2020).

Previous studies have also found that students who identify teacher support for learning with positive perspectives of failures have a broader repertoire of SRL strategies and use them more frequently, which allows them to adapt better to the academic context (DiFrancesca et al., 2016; Heirweg et al., 2020; Karlen, 2016). Recognizable teacher support has also been identified as a contributing factor to curiosity in learning, with the following other factors: learning content, peer collaboration in learning (Latifi et al., 2021), competition between learners (Song and Kim, 2020), critical thinking (Gkemisi et al., 2016) and an inclusive LEN (Blecker and Boakes, 2019).

The second equally important predictor of SRL seen from the results of this study, LEN, was analyzed as the information space surrounding the pupil in the school, which is characterized by the

curiosity and regulation of own learning. It is designed to purposely stimulate and empower student learning (Neifachas et al., 2022). Gershenson (2016) also observed in the results of her study that students' attitudes toward SRL are mostly shaped by the ways in which the content is delivered, which is the responsibility of the teacher, and the LEN that is shaped by the teacher's behavior toward the learners. Given these characteristics of the LEN, it is clear that not every LEN can become a student's perceived LEN. First, the learner must be interested in using the environment and second, must be able to actively participate in it. Teachers, when creating an inclusive and engaging LEN that develops students' SRL skills, must consider whether the environment provides their students with the opportunity to construct their learning direction, set goals and plan the actions they will take in that environment. Thus, students' recognition of their teachers' teaching and learning strategies in the LEN is an important factor of their development of SRL skills, as it encourages them to reflect on their learning abilities and styles, as well as on their knowledge, choice and use of learning strategies; to investigate more; to become more involved during the learning process; and to forge good friendships with other students, in which they help each other. Moreover, when they perceive their teacher as behaving equally toward all of them and taking care of them, they are more easily motivated to regulate their learning. On the other hand, if students do not correctly perceive the LEN modeled by their teacher, no matter how inclusive it may be, they will not learn successfully because they would not be able to adapt and regulate their learning in this environment, as they would be less likely to reflect on their own learning abilities (Russell et al., 2022), to search for ways and strategies to learn (Kirk-Johnson et al., 2019; Kornell and Bjork, 2007; McDaniel and Einstein, 2020), and to work constructively with new learning information (Stebner et al., 2022).

Therefore, the results of this study confirm H3 and H4, that LEN and SPTS influence students' self-regulation of learning, because if students have a good understanding of the simulated LEN and recognize the learning support provided by their teacher, they will be able to successfully search for and choose learning strategies, whereas if they do not recognize the LEN and SPTS, the conditions for the development of their SRL skills are missing.

Regarding H1 and H2, the results of this study revealed that there is no statistically significant relationship between teachers' direct teaching attitudes and their teaching strategies. However, the teaching and learning process that they organize has various components, through which they indirectly express and model their teaching according to their own dispositions to promote SRL. Nevertheless, this may be influenced by incorrect or inaccurate knowledge of SRL. Several studies have highlighted that teachers tend to have misconceptions about SRL, such as that it is likely to be self-developed rather than learned (Lawson et al., 2019) or developed only within the student's family (Callan and Shim, 2019). Due to this confusion with this concept, teachers may be reluctant to offer instruction or guidance to students about self-regulated learning processes. Furthermore, teachers with misconceptions about SRL may not uniformly emphasize its importance to students whom they perceive to be self-regulating their learning (Dignath and Büttner, 2008). This confirms the result of other studies (Greenquist-Marlett et al., 2025) that for teachers to be able to directly promote SRL among students, they must have

sufficient knowledge and skills in SRL development. Such result acknowledges that teaching attitudes and chosen teaching strategies often differ because teachers often lack time for self-regulated education due to their classes and other tasks.

There are many other factors that influence teachers' perceptions of SRL and strategies they use to develop SRL skills. Although teachers have many opportunities to develop students' SRL strategies in the classroom (De Boer et al., 2018; Azevedo et al., 2008), they rarely implement these fundamental learning skills (Dignath and Büttner, 2008). There is a misalignment between teacher SRL beliefs, knowledge, and practice (Spruce and Bol, 2015). Teachers often lack the skills to integrate SRL into their practice (Dignath and Büttner, 2008) and as a result do not consistently cultivate and apply these learning strategies (Dignath-van Ewijk and Van der Werf, 2012). On the other hand, as the results of this study show, the formal classroom environment—through the choice of teaching methods, the use of different and varied teaching strategies, the adaptation of teaching tools, the use of individual and group work methods—provides a favorable environment for the promotion of SRL. Students recognize the teacher's support for their learning, and they also appreciate the learning environment that is created, which confirms the different and unequal experiences of teachers in developing SRL in primary school pupils.

By paying more attention to teacher training, to the recognition factor of self-regulation, and to strengthening attitudes toward self-regulated learning, we should promote self-regulated learning in the early years at school. Research focusing on teacher-supported self-regulated learning in primary education, as well as on students' recognition of teacher-modeled learning environments and teacher-led learning support, should be continued. Thus, future studies should analyse teachers' attitudes and teaching strategies for promoting student self-regulation in the classroom LEN. They should investigate if existing teaching attitudes are reflected in the teaching strategies used to promote students' SRL. Moreover, the components of the classroom LEN created by the teacher should be analyzed more, as should the components through which the pupils themselves identify this LEN. Teacher professional development focusing on the development of SRL in practical classroom tasks is another area for future research.

The study has several limitations. Firstly, the study was conducted in six primary schools in Kaunas, with 253 pupils and 16 fourth grade teachers. Secondly, only those schools in Kaunas, the second largest city in Lithuania, with high learning outcomes were selected for the study. In the future, the research could be conducted in a wider range of contexts.

Conclusions

Based on this study's findings, the following conclusions are drawn:

1. There is a significant relationship between SRL and indirectly experienced teacher support during learning and through the created LEN. Students who perceive their teachers' support for learning and the LEN created by their teacher are encouraged to not be afraid to make mistakes and to reflect and learn from

their mistakes, which helps them effectively become involved in learning, adapt to different learning situations and actively develop SRL skills.

2. This study revealed that student-related factors that contribute to the development of SRL skills are SPTS, LEN, thinking about their own learning styles and strategies, and knowing that it is possible to change and try out different ways of learning. These imply students' satisfaction with their learning, increased engagement in classroom learning, pursuit of independent learning at home and motivation to learn and explore new learning approaches or strategies.

Data availability statement

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

Ethics statement

The studies involving humans were approved by Vytautas Magnus University's Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

JM: Writing – review & editing. LK: Writing – review & editing. OM: Writing – review & editing. EL: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

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

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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