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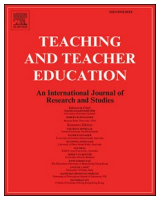
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Research paper



Pre-service teachers' ways of understanding, observing, and supporting self-regulated learning

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ABSTRACT

This study explores pre-service teachers' (PSTs') ways of understanding, observing, and supporting self-regulated learning (SRL). The implementation of an open-ended questionnaire ($N = 118$) was followed by a qualitative analysis based on Zimmerman's SRL framework. The PSTs reflected on their understanding of the phases of SRL: forethought, performance, and reflection. The PSTs demonstrated a theoretical understanding of SRL but a weaker understanding of how to observe and support students' SRL skills and their development. The findings have practical implications for teacher education and teachers' professional development.

1. Introduction

A recent emphasis in education has been on continuous and lifelong learning, which highlights the ability of individuals to regulate their own learning (de Ruig et al., 2023; Dignath & Veenman, 2021). Self-regulated learning (SRL) is defined as an active approach to learning in which students plan, monitor, direct (or redirect), and reflect on their personal learning processes and progress (Pintrich, 2000; Zimmermann, 2000). As a result, SRL can promote positive learning outcomes and the well-being of students (Cleary & Platten, 2013; Kistner et al., 2010) by increasing motivation to learn (Dignath & Büttner, 2008) and supporting the development of cognitive and social skills (Wolters, 2011). It is recommended that students receive support in their SRL development throughout their education, starting from an early age in preschool and primary education (Dignath & Büttner, 2008; Montroy et al., 2016; Perry & VandeKamp, 2000). The fundamental function of SRL skills is to prevent students from developing ineffective learning strategies when developing learning and self-efficacy beliefs (Montroy et al., 2016; Perry, 1998).

Despite the importance of SRL skills in today's rapidly changing and continuous learning–oriented world, relatively little attention has been paid to the competencies and intentions of teachers and pre-service teachers' (PSTs) in relation to promoting SRL in the classroom (Dignath & Büttner, 2018; Perry et al., 2008). In recent years, the focus of SRL research has shifted from directly training SRL skills to training teachers to support students in SRL (Kramarski, 2018; Kramarski & Kohen, 2017). However, the ways in which teachers can support students' SRL development and which kinds of SRL teaching practices effectively promote SRL development are still poorly understood (Dignath & Veenman, 2021; Michalsky & Schechter, 2013).

Teacher education plays a key role in supporting PSTs' own SRL skills and their ability to support students' SRL skills in the future, so SRL content should be included in teacher education. Opportunities for PSTs to construct an understanding of SRL, develop SRL skills, and practise teaching SRL could increase the number of students with academically effective approaches to learning (Gan et al., 2020; Perry et al., 2007). However, relatively little research has been conducted to explore PSTs' understanding of SRL at a conceptual level and their understanding of how SRL can be observed and supported in pedagogical practice in authentic classroom interactions. Therefore, the aim of this study is to explore PSTs' insights into understanding, observing, and supporting SRL.

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Table 1
The code protocol of the analysis.

Themes	Category	Subcategory	Description	α
Forethought phase	Motivation	Student: Motivational regulation	Regulation of one's own willingness to learn, enthusiasm and general motivation to learn.	0.92
		Teacher: Motivating	Using different incentives to motivate and encourage students to learn.	0.94
	Strategic planning	Student: Strategic planning skills	One's ability to organize or make plans for their own learning.	0.94
		Teacher: Strategic planning support	Teaching strategic planning or supporting the planning process	1.0
	Learning capabilities recognition	Student: Self-efficacy	One's ability to conceptualise their own abilities, strengths, and weaknesses. Self-awareness during learning process.	0.77
		Teacher: Learner knowledge	Knowing or getting to know one's own learners and supporting and guiding them individually while noticing differences.	0.88
	Goal setting	Student: Goal setting	Setting goals, considering a suitable learning goal.	0.83
		Teacher: Goal setting support	Supporting the choosing of a suitable learning goal, guiding learners towards goal setting process.	0.81
	Observing SRL	Teacher: Observing students' forethought	Observing leaners' skills related to the forethought phase	0.70
Performance phase	Goal-oriented work	Student: Goal-oriented learning	One's own orientation towards learning and actively taking their own learning in an appropriate and goal-oriented direction.	0.71
		Teacher: Creation of supportive learning environment	Modifying the learning environment and tasks to enable self-regulation in learning.	0.90
	Learning strategies	Student: Use of learning strategies	Fluent use of learning strategies. Making choices related to suitable learning strategies.	0.88
		Teacher: Teaching learning strategies	Teaching different learning strategies and supporting learner in choosing suitable strategies	0.74
	Need of support	Student: Help-seeking behaviour	Help-seeking or non-help-seeking behaviour. Learner asking questions in learning.	0.70
		Teacher: Regulation of support	Supporting learners when needed. Supporting learners and taking their ages and skills into account.	0.80
	Metacognitive monitoring	Student: Self-monitoring	Understanding that learning is for themselves, and they are responsible of their own learning.	0.87
		Teacher: Support of self-monitoring	Giving learner the opportunity to take responsibility for their learning, giving learners space to make their own decisions.	0.95
	Self-control	Student: Self-control	One's self-control during the learning process. Ability to concentrate, self-initiative working, control of learner's own activities.	0.88
		Teacher: Support of self-control	Supporting and teaching learners' self-control verbally by giving advice and nonverbally being an example of regulating one's own behaviour.	0.77
	Time management	Student: Time management skills	Timing and scheduling one's own learning, staying on time.	0.93
		Teacher: Teaching time management skills	Supporting or teaching time management.	1.0
	Observing SRL	Teacher: Observing students' performance	Observing leaners' skills referred to performance phase	0.92
	Feedback	Student: Learning from feedback	Using received feedback (from a teacher or a peer) as an instrument for learning.	0.70
Reflection phase	Feedback	Teacher: Feedback	Teacher giving feedback to a learner.	0.77
	Reflection	Student: Self-reflection	Self-reflection and self-assessment after learning.	0.86
		Teacher: Observing students' reflection	Observing leaners' skills related to reflection phase	1.0
	Assessing SRL	Teacher: Assessing SRL through learning achievements	Teacher assessing SRL through learner's achievements and learning outcomes, for example, by using summative assessment tools or learning analytics.	0.92
		Teacher: Assessing SRL through dialogue	Dialogues between teacher and learner and making SRL assessment based on these.	0.81

2. Theoretical framework

2.1. Self-regulated learning

Self-regulated learning has been recognised as an important learning skill, and a student with high SRL skills is often described as a person who believes in their own abilities and is willing to learn and improve their skills (Pintrich, 2000). Students with high SRL skills are aware of their strengths and weaknesses, control their emotions when necessary, and actively use a variety of activities to regulate their learning (Boekaerts, 1995; Endedijk et al., 2012). They achieve these goals by acknowledging and reflecting on their own role in the learning process, setting goals, and planning and monitoring learning processes (Endedijk et al., 2012). Furthermore, it has been argued that motivational and emotional regulation factors play a crucial role in initiating and maintaining learning-oriented behaviour (Wolters, 2003), as they shape SRL processes by strengthening, directing, or maintaining motivational and emotional SRL strategies (Bakhtiar et al., 2018; Wolters, 2003). Self-regulated learning is not an innate trait, which means that cognitive, motivational, and emotional regulation strategies can be learned; they are dynamic and contextual processes under the control of the student (Pintrich, 2000; Zimmerman, 2002).

Self-regulated learning is commonly defined in terms of the dynamic phases of learning, and most SRL theories have included cycles corresponding to the phases before, during, and after learning when SRL takes place (e.g. Pintrich, 2000; Winne & Hadwin, 1998). A widely accepted and utilised model in the research literature is Zimmerman's (2000) three-phase model, which is based on social cognitive theories and consists of forethought, performance, and reflection phases. More elements have been retroactively added to these phases to enlarge the metacognitive processes of SRL (Zimmerman & Moylan, 2009). According to Zimmerman's cyclical model (2000), the forethought phase involves students' efforts to prepare for the upcoming learning process with two interrelated components, task analysis and self-motivational beliefs. An important form of task analysis involves goal setting and strategic planning. Self-motivational beliefs refer to the process of orienting oneself towards the learning process. The performance phase involves methods of self-monitoring and self-observation that help students progress with a learning task in a learning situation. Time-management skills and help-seeking behaviour while learning are examples of strategic processes that help students complete their tasks and achieve their goals. Finally, the reflection phase consists of

Table 2
PSTs' insights regarding understanding SRL.

SRL phase	SRL skills	*n* (%) of participants
Forethought phase *n* = 80 (67.8 %)	Motivational regulation	38 (32.2 %)
	Goal setting	39 (33.1 %)
	Strategic planning	29 (24.6 %)
	Self-efficacy	24 (20.3 %)
Performance phase *n* = 103 (87.3 %)	Self-control	77 (65.3 %)
	Use of learning strategies	53 (44.9 %)
	Goal-oriented learning	45 (38.1 %)
	Self-monitoring	36 (30.5 %)
	Help-seeking behaviour	36 (30.5 %)
	Time management skills	29 (24.6 %)
Reflection phase *n* = 47 (39.8 %)	Self-reflection	38 (32.2 %)
	Learning from feedback	19 (16.1 %)

self-evaluations and self-reactions, through which students reflect on the experience and potentially learn from it.

2.2. The Teacher's role in observing SRL

In general, SRL originates in social cognitive theory (Bandura, 1986) and involves more than the students' personal processes, which are thought to be reciprocally influenced by environmental and behavioural events (Bandura, 1986; Zimmerman, 1989). This means that the development of SRL can be observed and supported, and teachers play a crucial role in this process (de Boer et al., 2018; Dignath & Veenman, 2021).

Previous studies have developed various ways of observing and assessing SRL, such as subjective self-reports, classroom observations, interviews, and multi-method approaches (see, e.g., Boekaerts & Corno, 2005; Dörrenbächer-Ulrich et al., 2021; Heirweg et al., 2019; Zimmerman & Martinez-Pons, 1986). However, there has been limited research on teachers' methods of observing students' SRL in practice. A small number of previous studies have found that teachers rarely have a comprehensive understanding of the complete SRL cycle – teachers' often focus their assessment on cues unrelated to SRL or have other demonstrable misconceptions related to assessment (Dignath & Sprenger, 2020; Karlen, Hirt, et al., 2023). However, to properly promote students' SRL skills, teachers need to understand students' needs and strengths through observation and assessment (Karlen et al., 2020, 2023; Michalsky, 2017). Bolhuis and Voeten (2001) found in their classroom observations that teachers observe their students between lessons by listening and observing their learning, but this is rarely a consistent part of their teaching. Furthermore, teachers were found to mainly use offline assessment approaches (e.g. questionnaires, interviews, reflective discussions, and learning diaries) rather than online approaches (e.g. observations during learning and log traces), and teachers showed low variability in their SRL assessment activities (Karlen, Hirt, et al., 2023; Michalsky, 2017).

Whitebread et al. (2009) reported observational tools for assessing SRL in young children that allow educators to utilise checklists that include emotional, social, cognitive, and motivational aspects. Koivuniemi et al. (2021) reviewed existing instruments for assessing SRL in primary, middle, and secondary schools, and their findings suggested that more can be done to measure students' SRL skills at different phases of the regulated learning cycle. They recommended that SRL supports be designed to explicitly target motivation and emotion regulation and to recognise the differences between SRL phases (i.e. forethought, performance, and reflection [Zimmerman, 2000]). Overall, previous research designs have emphasised the cognitive aspect of SRL and its forethought and performance phases, while less research has focused on reflection and evaluation and their support (Koivuniemi et al., 2021).

2.3. The Teacher's role in supporting SRL

Previous research (Dignath & Veenman, 2021; Pino-Pasternak et al., 2014) has shown that the practice of supporting SRL as part of teaching and learning in the classroom is relevant to students' engagement in SRL, and that there are teaching practices and elements of the learning environment that promote students' engagement in SRL. According to these elements, to support SRL the teacher can provide complex and meaningful activities through which students can influence their own learning and learning methods by, for example, selecting the level of challenge and the learning environment and deciding on the amount of support that is needed (Perry, 1998; Perry & VandeKamp, 2000). Recently, research has focused on developing training models and tools through which teachers can support students in SRL (e.g. Alvi & Gillies, 2018; Dignath & Büttner, 2018). For example, Dignath and Büttner (2018) studied primary and secondary school teachers' knowledge, beliefs, and ways of supporting SRL through classroom observation and found that teachers could benefit from learning about SRL strategies and metacognition. According to Dignath and Veenman's (2021) systematic review of classroom observations of SRL, teachers can promote students' SRL skills directly by teaching strategies and indirectly by creating a learning environment that allows students to regulate their own learning. That study discovered a significant positive relationship between the teaching of SRL and students' use of SRL strategies; however, it also found that teachers tended to promote SRL indirectly by creating a learning environment that encouraged SRL and that this approach was not an effective way to support SRL – the direct teaching of strategies was also needed. The review further found that very little direct teaching of metacognitive strategies was being used to support SRL; these findings were consistent across countries, school types, and subjects. Alvi and Gillies (2018) studied how teachers supported students' SRL in classroom practice, and their case study revealed that teachers facilitated the process of learning by clearly establishing the necessary goals for supporting students' SRL. Although teachers can potentially contribute a great deal to their students' SRL, it appears that teachers are not sufficiently supportive of SRL and may lack the confidence to explicitly teach and support SRL strategies (Dignath & Büttner, 2018; Hattie & Yates, 2014). For instance, teachers rarely spend enough time explaining SRL strategies, asking students questions about the learning process, or providing necessary learning strategies when creating educational environments that allow students to engage in SRL (Bolhuis & Voeten, 2001; Dignath & Büttner, 2008). Although studies have

Table 3
PSTs' perspectives on teachers' ways of observing and assessing SRL.

Observing and assessing SRL	Ways of observing and assessing SRL	*n* (%) of participants
Observing phases of SRL *n* = 84 (71.2 %)	Observing learner's forethought	17 (14.4 %)
	Observing learner's performance	72 (61.0 %)
	Observing learner's reflection	24 (20.3 %)
Assessing SRL through achievements and dialogue *n* = 65 (55.1 %)	Assessing SRL through learning achievements	47 (39.8 %)
	Assessing SRL through dialogue	35 (30.0 %)

Table 4
PSTs' perspectives on teachers' ways of supporting SRL.

SRL phase	SRL support skills	*n*(%) of participants
Forethought phase $n = 69$ (58.5 %)	Motivate students	39 (33.1 %)
	Increase students' knowledge	37 (31.4 %)
	Support goal setting	20 (16.9 %)
	Support strategic planning	10 (8.5 %)
Performance phase $n = 95$ (80.5 %)	Create supportive learning environment	71 (60.2 %)
	Regulate support	44 (37.3 %)
	Support executive functioning skills	31 (26.3 %)
	Give responsibility	24 (20.3 %)
	Teach learning strategies	22 (18.6 %)
	Teach time management strategies	7 (5.9 %)
Reflection phase $n = 17$ (14.4 %)	Provide feedback	17 (14.4 %)

shown the importance of feedback for the development of students' SRL skills (Butler & Winne, 1995), the current level and kind of feedback is usually neither sufficiently informative nor included as SRL support (Bolhuis & Voeten, 2001; Koivuniemi et al., 2021). Overall, teachers have been found to have limited knowledge of how to support SRL (e.g. De Smul et al., 2018; Dignath-van Ewijk & van der Werf, 2012; Spruce & Bol, 2015). Despite evidence that teaching can improve SRL (Perry & Rahim, 2011), there is still only limited understanding of how teachers can most effectively support students' SRL in classroom interactions (Dignath, 2008; Dignath & Veenman, 2021).

2.4. Teacher education and practices to support PSTs' understanding of SRL

Concerns about the state of PSTs' knowledge of SRL are evident in the research literature (Dignath & Sprenger, 2020; Lawson et al., 2019, 2023). Previous research has shown that individuals' beliefs influence their behaviour (Pajares, 1992). Therefore, it is important to understand PSTs' perspectives on SRL in order to support their professional development as future teachers. Previous research has integrated SRL interventions into initial teacher education to activate PSTs' own SRL and teaching and to implement the promotion of SRL early in teacher education (Kramarski & Kohen, 2017; Kramarski & Michalsky, 2010; Näykki et al., 2021; Perry et al., 2008). For example, Kramarski and Kohen (2017) used an intervention study based on Zimmerman's (2000) cyclical model to explore PSTs' development in SRL as students and as teachers; their findings highlighted that PSTs are also students who need to be guided to improve their SRL skills. In Perry and VandeKamp's (2000) study, PSTs shared a common goal of helping students become independent and effective students, but they were not confident in their judgments about how much support their students needed or what type of support would be most effective. In the study, the researchers offered PSTs and their experienced mentor teachers a range of practices that would help the PSTs support SRL in primary school education. Through a year-long teacher training programme that included SRL-related coursework, classroom practice, mentoring, and professional development activities, PSTs learned how to support the development of SRL in their students. The results of Perry and VandeKamp's (2000) study suggested that even novice teachers can learn complex pedagogical activities with appropriate support and mentoring. However, more research is needed to understand how PSTs understand SRL and what kind of support PSTs require to expand and evolve their teaching practices to support the development of students' SRL skills (Lawson et al., 2023; Michalsky & Schechter, 2013; Perry et al., 2008; Porter & Peters-Burton, 2021).

3. Aims and research questions

This study aims to explore PSTs' insights on understanding, observing, and supporting SRL. The research questions are as follows:

1. How do PSTs understand the concept of SRL?
2. What methods do PSTs describe for observing and assessing students' SRL?
3. What methods do PSTs describe for supporting students' development of SRL skills?

4. Methodology and methods

4.1. Teacher education in Finland

In Finland, teacher education takes place in universities and universities of applied sciences. Pre-primary and primary school teachers (pupils aged 5–12), special education teachers (all ages), and subject teachers (pupils aged over 12) are trained at universities, while vocational teacher training (adolescent and adult students) is organised at universities of applied sciences. Teachers trained at universities must complete both pedagogical and field-specific studies. Teacher education in Finland is at the bachelor's (pre-primary teachers), master's (primary school, special education and subject teachers), or postgraduate level (vocational teacher). Teacher education programmes use different teaching and learning environments (face-to-face, online, and hybrid) and various teaching and learning methods (e.g. self-study courses, written examinations, essay writing, and group work), including teaching practice. In Finland, student-centred learning, including SRL, is a common pedagogical approach that is also a part of the curricula at different school levels (see, e.g., Kumpulainen, 2018). Therefore, SRL is quite often part of teacher education programmes, and PSTs are expected to be familiar with the topic.

Participants and Procedure This qualitative questionnaire study involved 118 participant PSTs (76% female, 16% male, and 8% other or did not indicate gender) from four higher education institutions in Finland. The participants voluntarily participated in the study during teacher training courses. Of the participating PSTs, 53 (44.9%) were studying to become primary school teachers, 47 (39.8%) to become vocational teachers, 9 (7.6%) to become subject teachers, and 2 (1.7%) to become special education teachers; 7 (6.0%) did not specify their educational background. Their ages ranged from 23 to 56 years, with a mean of 32.6 years and a standard deviation of 9.1. Their teaching experience ranged from 1 year to more than 9 years; the mean was 3.6 and the standard deviation 2.3.

4.2. Data collection and analysis

Data were collected in the spring of 2022 using an online questionnaire that included multiple-choice questions and open-ended questions. This article focuses on PSTs' responses to the open-ended questions about SRL and teachers' ways of observing and supporting students' SRL. This rich data set was qualitatively analysed on its own to enable a broad and accurate reporting of participants' understanding of SRL (Lincoln, 2021). The quantitative part of the data (the multiple-choice questions) focused on the participants' own SRL skills and skills to scaffold SRL and will be reported elsewhere. The open-ended questions were as follows: (a) How do you understand SRL? (b) How can one improve SRL skills in practice? (c) How can a teacher support students' SRL skill development? (d) How can a teacher observe the development of students' SRL? and (e) How can a teacher know if a student in the class has high or low SRL skills?

Data analysis was organised using qualitative content analysis (Hsieh & Shannon, 2005) and by combining concept-driven and data-driven approaches (Schreier, 2012). The analysis was carried out in the following order: familiarising with the data, designing the coding

protocol, coding and categorising the data by using the Atlas.ti analysis programme, reporting the number of respondents in each category, and evaluating the reliability of the analysis.

The initial coding protocol was developed after two researchers independently read through all the data several times. Before discussing, both researchers took notes on the data and identified themes related to SRL. In general, qualitative content analysis may include concept-driven categorisations, especially regarding the main categories (Schreier, 2012). Zimmerman's (2000) process model of SRL phases (forethought, performance, and reflection) served as the basis of the coding protocol to analyse insights related to PSTs' understanding of SRL in general and the ways in which teachers can observe and support students' SRL. Zimmerman's cyclical model of SRL has been widely used in SRL research into students' SRL skills and their support by teachers (Koivuniemi et al., 2021; Kramarski & Kohen, 2017; Lombaerts et al., 2007).

When analysing open-ended questionnaire data, extensive coding may be required because of the wide variety in responses (Reja et al., 2003). Therefore, in addition to Zimmerman's (2000) SRL model, previous research was used to capture PSTs' perspectives on observing and supporting SRL (see, e.g., Alvi & Gillies, 2018; Butler & Winne, 1995; Dignath & Veenman, 2021; Karlen, Hirt, et al., 2023; Koivuniemi et al., 2021; Whitebread et al., 2009; Zimmerman & Moylan, 2009). By following the previous studies, it was possible to connect Zimmerman's (2000) model of student's ways of regulating their own learning to the teacher's role in SRL strategies and development. To fully explore the topic, this study incorporated data-driven strategies in addition to the concept-driven approach (Schreier, 2012). This combination of approaches is commonly utilised to reflect the fact that main categories are from theories, while the creation of subcategories is based on data (Schreier, 2012). This protocol is evident in the construction of subcategories (see Table 1), which is consistent with Zimmerman's (2000) framework, but it also incorporates views from other prior studies and the data-driven approaches to obtain a wide range of perspectives. For example, *feedback* and the *creation of a supportive learning environment* both emerged from the data and have been observed to be supportive instruments for SRL (Butler & Winne, 1995; Dignath & Veenman, 2021); therefore, these subcategories were added to the coding scheme.

After discussing and creating the coding protocol, the researchers began coding the data into thematic units using Atlas.ti 23 software. The analysis proceeded by categorising the data into phases of SRL and implementing subcategories within each phase (see Table 1 for an example of category coding). During the analysis, participants' responses were grouped into categories by identifying when they described SRL as a skill, the ways in which teachers can observe the development of SRL skills, and the ways in which teachers can support the development of SRL. Each time a participant's response included a description of these named categories, part of the reflection was coded to the specific theme.

In the next stage of the analysis, the coded reflections were further analysed by counting the frequency of responses in each category. The researchers noted that the participants built up their understanding of SRL throughout the process of answering the open-ended questionnaire – they expanded on their previous answers and sometimes repeated themselves. After determining the number of respondents in each category, the reliability of the analysis was analysed. Krippendorff's alpha binary (α) was used to assess the agreement of the coding of the main categories and subcategories. Two independent researchers coded 40% of the data, and Krippendorf's alpha values for different subcategories were between 0.70 and 1.0, representing good to perfect agreement (Neuendorf, 2016). The value was counted in the Atlas.ti analysis programme. Reliability by code is presented in Table 1.

5. Results

The results of this study are presented in three sections according to the research questions: PSTs' (a) conceptual understanding of SRL and their views on (b) observing and (c) supporting SRL development. In each section, the findings follow the basic three-part SRL structure (phases of forethought, performance, and reflection; Zimmerman, 2000).

5.1. How do PSTs understand SRL?

In this study, PSTs viewed students' SRL through the different phases (forethought, performance, and reflection), identified multiple targets of SRL (e.g. cognitive and motivational regulation), and referred to various SRL strategies (e.g. time and resource management strategies and increasing the self-efficacy of learning). When asked to define and describe SRL, the PSTs ($N = 118$) most often reflected on skills related to the SRL performance phase ($n = 103$), followed by the SRL forethought phase ($n = 80$); the participants mentioned SRL reflection skills ($n = 47$) the least often in their written responses (see Table 2).

When defining SRL, the PSTs described the forethought phase by describing the skills that help students plan their learning processes. The PSTs mentioned motivational regulation and goal setting most often, which, according to one of the participants (S21), 'creates a flow that guides the whole learning process'. The PSTs also described strategic planning, the importance of planning the overall learning process, and identifying the subtasks necessary to complete the task. One of the participants (S110) summarised SRL as 'knowing what, when, where, and why the learning process should be carried out'. Several PSTs also stated that it is important to have self-efficacy in learning and to know one's personal learning needs, strengths, and weaknesses, combined with other SRL skills.

> 'The [self-regulated] students know their weaknesses and strengths as learners. They know different learning techniques and use them to their advantage to learn best. Self-regulated learning is also goal-oriented and planned' (S30)

> 'A student knows how they learn best and can work according to this' (S89)

Of the three phases of SRL, the PSTs most often associated SRL skills with the student's performance phase. The participants highlighted the student's self-control as a crucial part of SRL, i.e. the ability to control their actions while achieving the learning goals and objectives. In addition, the PSTs identified the fluent use of learning strategies when performing a learning task – the ability to use various strategies and tools and to choose the most appropriate environment for facilitating learning – as an important SRL skill. Several PSTs considered goal-oriented learning, in which goals are given by the teacher, set independently, or set with the help of the teacher, to be central to purposeful learning. Some PSTs approached the goal-oriented mindset by defining what it is not about: 'A low-achieving student does not know how to focus on the target activity, does not understand the learning goals, or is not interested in working towards them' (S63).

The PSTs mentioned that self-monitoring is a key skill in self-regulating one's own learning. They believed that students with high SRL skills can monitor and take responsibility for learning outcomes and act to direct or (re)direct their learning processes. Although self-monitoring was only seen as a strength, help-seeking behaviour was seen from two perspectives. Most of the PSTs thought that the need to ask for help reflected high SRL, while others thought that asking for and accepting help could be an indicator of low SRL skills:

> '[It is important to] remind them not to bang their head against the wall for too long and to remind them that the student can contact the teacher. Just knowing that can help the student to find a solution on their own' (S20)

> 'I think that self-regulated learning is straightforward and uncomplicated learning. That is, someone teaches you something → you learn it. In addition, in some ways, I associate it with when the

teacher gives the students a task from a textbook, and they do it without any major challenge or instruction or help from the teacher' (S86)

In the performance phase, time-management skills were also seen as part of the SRL strategies. The importance of time scheduling was mentioned as a way to 'learn to manage their own schedules' (S89) and to facilitate 'successful completion of the scheduled tasks' (S93).

Lastly, SRL related to the reflection phase was the least frequently mentioned in this study. Reflection skills were mostly understood as the ability to self-evaluate one's own learning, described as the ability to analyse one's learning and identify areas for growth, which helps the student learn from mistakes and successfully complete tasks. Self-evaluation was interpreted as a future-oriented skill that supports the student in the process of constant and continuous learning: 'In self-regulated learning, the student wants to improve him/herself and is willing to reflect on his/her way of thinking and acting in learning. Learning is perceived as processual and continuous' (S31).

A few of the PSTs mentioned that feedback can be used as a learning tool to improve one's own learning. Despite the low frequency of this observation, one of the participants (S20) described how 'the value of feedback is extremely important in learning how to regulate one's learning'. The PSTs did not describe the structure of such feedback in detail. Instead, it was rarely and briefly mentioned as a tool that the student could use to improve self-efficacy and overall future performance.

'Students' performance should be evaluated, and in this case the students themselves play a key role in evaluating their own performance with the support of the teacher's feedback. In this way, students can see themselves as part of the learning process and learn to recognise the skills they already have to achieve learning' (S109)

In conclusion, the participants primarily associated SRL with various forethought- and performance-related skills rather than emphasising the importance of reflection and feedback in SRL.

5.2. *What methods do PSTs describe for observing and assessing students' SRL?*

When asked to describe teachers' ways of observing students' SRL skills and their development, the PSTs mentioned various ways of observing SRL phases and assessing SRL skills (Table 3). Eighteen per cent of the respondents did not answer the questions about observing SRL skills and their development. The following results follow the basic order of the SRL phases, followed by the results on assessing SRL.

According to the PSTs, by observing the student the teacher can see how well the students' SRL skills are developed and how the student is participating in that development. The PSTs' responses on observing students were divided into subcategories according to the SRL phases: observing students' forethought ($n = 17$), observing students' performance ($n = 72$), and observing students' reflection ($n = 24$). The PSTs mentioned that teachers can, in addition to observing students at different phases of SRL, assess SRL skills and development through student achievements ($n = 47$) and teacher-student dialogue ($n = 35$).

Observing the students' forethought was defined as the teacher's actions to keep abreast of the beginning of the students' learning processes. According to the PSTs, the teacher could observe the forethought phase by observing the students' planning, scheduling, and goal setting. One of the PSTs mentioned that the teacher could 'ask the student for a learning plan and timetable in advance, and then follow up if the student stays on the plan' (S14). One participant also described how student observation should be 'started in childhood, and self-regulated learning can be developed by, for example, creating goals and plans for learning progress and following the progress' (S10). The PSTs also highlighted the meaning of motivation and attitudes towards learning, for example, describing the observation of SRL skills and development 'on the basis of attitude and motivation' (S28) or mentioning 'observing the level of motivation in learning' (S97). Participant S54 noted the following:

'[The level of the students' SRL skills] is difficult to detect, the teacher will notice it over time. Perhaps a tightly controlled timetable of free-format text tasks can give a clue from the start: if someone can't make it on time, the teacher can draw attention to the problem and possibly break it up into smaller pieces'

Evaluating students' performance was seen by the participants as an important way of observing students' SRL skills and their development. Over 60% of the PSTs mentioned that observing a student's performance was an important part of identifying their SRL skills. In their responses, the PSTs mentioned observing and monitoring students' actions from a distance. For example, the PSTs stated that the teacher can 'observe the progress in learning tasks and observe the students' need for help' (S12) or observe the students' concentration on the learning task because 'difficulties with concentration might reveal that a student has weak self-regulated learning skills' (S27). Some PSTs linked the observation of student performance to 'observing the assumption of responsibility' (S85), and another PST stated, 'I actively monitor in class how the students are involved in the topic being discussed' (S17). Participant S82 stated the following:

'The teacher can give different kinds of tasks to the pupils and regulate the schedules of the tasks, and then the teacher can observe how the pupils can complete the task in question. In this way, the teacher gets information about how self-regulated the pupils are and what kind of activities suit each pupil'.

One-fifth of the PSTs stated that a teacher could observe students at the end of the learning process to monitor their SRL skills. Most of the respondents linked the observation of student reflection to the teacher's action of observing the students' self-reflection process. Many of the PSTs' responses when they were asked to describe methods for observing SRL skills included a mention of self-reflection. Some PSTs further defined the observation of self-reflection by saying, for example, that the teacher could observe 'the students' enthusiasm towards self-reflection' (S21). A few participants highlighted that the teacher could observe SRL skills 'by setting self-reflection tasks on SRL skills' (S66).

According to the PSTs, assessing SRL through learning outcomes is another way to discover students' SRL skills and development. Almost 40% of the PSTs stated that the teacher can gain information about students' SRL skills by looking at their learning achievements and outcomes. These learning achievements can be assessed through learning portfolios and reports, homework assignments, and various learning analytics collected by the teacher.

'[Observing] the analytics (for instance, the time spent with learning materials or time spent on a learning platform)' (S18).

'Formative assessment. Also, different types of tasks give information [about SRL], for example, problem-solving tasks or tasks with responsibility' (S116).

Finally, the importance of dialogue between teacher and student was emphasised in the PSTs' responses as a part of SRL skills and their development. Participants stressed the importance of dialogue, discussion, and communication. This is reflected in the mention of constructive guidance discussions and 'dialogical connection' (S42): 'It is crucial to engage in dialogue and to assess the students' achievement of goals' (S40); 'By asking the student, preferably in private. Shy students do not tell others about possible obstacles to learning' (S26). Taken together, PSTs highlighted the importance of observing students in different phases of SRL. When observing students' SRL skills and development, PSTs mentioned that teachers may additionally assess SRL through achievements and dialogue.

5.3. What methods do PSTs describe for supporting students' development of SRL skills?

The results shown in Table 4 describe the PSTs' ways to support students' SRL through the forethought ($n = 69$), performance ($n = 95$), and reflection ($n = 17$) phases. The results are shown in the order of the SRL phases.

The PSTs described multiple ways to support SRL in relation to the forethought phase of learning, elaborating on ways to support students in planning their own learning. Approximately one-third of the PSTs described how a teacher could motivate students to work in a more self-regulated way by providing both intrinsic and extrinsic motivations, for example, 'giving the pupils tips on what to focus on, and encouraging them with incentives such as stickers, etc.' (S12). An almost equally popular response was to increase teachers' knowledge about their students – one of the PSTs highlighted that the teacher has an important role to play in 'recognising different students and, in this way, providing different learning materials' (S17).

> 'Knowing your students helps [to support SRL], and usually every student has something that you can point out and give them a boost to learn – for some students it might be a permission to work in pairs or groups, or work in a different learning environment (on the floor, etc.). Some students need different methods to learn: listening, writing, speaking, or visual/digital learning' (S98).

According to the PSTs, facilitating goal setting and strategic planning are relevant to supporting SRL in the forethought phase. Goal setting can be supported by guiding and teaching students to reflect on their own learning goals. Furthermore, one of the PSTs emphasised that once students have set their goals, it is important 'to appreciate each goal in the learning situation despite the differences [in individual goals]' (S21). Strategic planning support was described as a way of supporting the planning and organisation of the learning process. A teacher can 'give students a chance to influence their own learning process, which will guide them to the path of SRL skills' (S57). One of the participants also mentioned that the teacher can 'get the student to think for themselves, what [equipment] they need during the lesson and where they should go next, etc.' (S78).

The PSTs mostly associated SRL support with aspects related to the performance phase, highlighting the importance of supporting SRL by guiding students' actions and performance in various ways. Sixty per cent of the PSTs considered creating learning situations and tasks that develop SRL to be an important method of supporting SRL. The participants noted that the teacher has an important role to play in supporting students' SRL development by providing open-ended and self-directed learning tasks and materials. Many of the PSTs considered group tasks and student-centred teaching an important part of creating SRL-supportive learning situations. Some of the PSTs also mentioned that the teacher can provide support 'by pointing out the link between the learning and practice' (S18).

> 'A teacher has an important role to play in creating the framework within which a student can self-regulate. It is important [for the student] to experience success and joy at the beginning of the learning process' (S49).

Additionally, more than one-third of the PSTs highlighted the importance of regulating teacher support in the performance phase by taking into account the age and individuality of the student – for example, by 'breaking down the subject matter into smaller parts as needed so that the student can gradually begin to structure his or her learning' (S68). According to the PSTs, the teacher should support students on a daily and individual basis, bearing in mind that different students need different amounts of support. One of the participants responded that primary school teachers can 'support the development of SRL skills from the beginning [of school] and gradually add independent ways of working to the lessons' (S6). Another aspect of supporting SRL in the performance phase is the support of self-control, which, according to the participating PSTs, refers to the teacher's reminders or demonstrations of SRL behaviour. For a student with weak SRL skills, 'written instructions may be difficult to understand, so [the student] needs a teacher to guide and give the instructions explicitly' (S68).

Twenty per cent of the participants mentioned supporting students' self-monitoring and supporting SRL in the performance phase by encouraging students to take responsibility. Support for self-monitoring should be gradual, and teachers should include students' independent decision-making in the learning process. According to the PSTs, it is important 'to give students something they can be responsible for' (S73) and to 'give the student space to practice their own thinking' (S116).

In addition, the teaching of learning strategies emerged as a way to support student activity. In this case, participants noted that it is important to teach which learning strategies work in different situations; the PSTs described that SRL can be supported by 'practicing different learning strategies' (S74) and 'finding different ways of learning and finding ways of learning that are appropriate for an individual' (S55). Some PSTs mentioned supporting students' time-management skills as a way of supporting SRL in the performance phase. This support was defined by the participants as teaching and introducing different ways of scheduling the learning process. One of the PSTs stated that the teacher should 'give schedules about school little by little, at the student's own pace' (S44). Another mentioned that it is important to 'tell students about the importance of time management' (S95).

Finally, the results related to the reflection phase showed that feedback was identified as a way to support SRL in the final phases of the learning process ($n = 17$). According to the PSTs, feedback can support both the overall learning process and the students' ability to reflect on their own learning. One of the participants observed that 'feedback helps to motivate students and promote their learning' (S33). Some PSTs saw developmental feedback as an important part of SRL support; they mentioned that a teacher can support students' SRL 'by giving them encouraging feedback' (S27). One participant highlighted the belief that the teacher should 'praise the student for good work and respond to any challenges the student may have' (S42). In summary, when the PSTs described methods for SRL support, they predominantly emphasised activities related to the performance phase, with the least mentions related to the reflection phase.

6. Discussion

The present study explored and described PSTs' insights into understanding, observing, and supporting SRL. The discussion is presented according to the research questions: how PSTs understand SRL and their views on observing and supporting SRL development.

6.1. How SRL is understood among PSTs

The first research question sought to explore PSTs' understanding of SRL in general. The participants highlighted all phases of SRL, forethought, performance, and reflection (Zimmerman, 2000), when describing how they understand the concept. They placed the most emphasis on the performance phase, slightly less on the forethought phase, and the least on the reflection phase. PSTs often emphasised self-control, the use of learning strategies, and goal-oriented learning, which may be explained by the visibility of these processes in the classroom. The minimal mentions of the reflection phase stand out in the results, which are consistent with Dignath and Sprenger's (2020) study, in which teachers described more SRL strategies related to the forethought and performance phases than to the reflection phase. Previous research has shown that the reflection phase is very important in completing a self-regulatory cycle and further guiding the learning process (Zimmerman, 2000). In the reflection phase, the students review their own learning processes and may identify aspects that were successful and those that need improvement in upcoming tasks. According

to Zimmerman's theory (2000), self-reaction is considered part of the reflection phase. In this study, however, PSTs did not describe self-reactions as part of SRL, and this may be one of the reasons why their descriptions of the reflection phase were narrow.

The results also show that the PSTs focused more on the cognitive and motivational aspects of SRL, for example, strategic planning, self-monitoring, and motivational regulation. It is well known that emotional regulation plays an important role in SRL (Bakhtiar et al., 2018; Boekarts, 2011; Wolters, 2003); however, in this study, the participants did not connect emotional regulation to SRL. The same concern emerged in Dignath and Sprenger's (2020) study of in-service teachers. This is a somewhat surprising repetitive finding, given that various emotional and socioemotional challenges are often described in the research and also in the public discourse around schools and schooling. Further, previous studies have shown the importance of teachers' emotional support (Bakhtiar et al., 2017; Ruzek et al., 2016) and the teacher's role as a co-regulator of emotions with students (Kostøl & Mänty, 2024; Taxer & Gross, 2018). Based on the findings of this study, it seems that the PSTs did not recognise, for example, students' emotional challenges and regulation as part of the strategic process of SRL. However, with a different research design, such as an observational study design, PSTs may have viewed emotional regulation as part of SRL. Given that beliefs influence teachers' actions in the classroom (Pajares, 1992), more research is needed to investigate PSTs' views of emotional regulation.

6.2. PSTs' methods for observing and assessing SRL

This study explored PSTs' views on how teachers can observe and assess students' SRL. There has been little research on teachers' opinions on this topic, especially from the perspective of PSTs, which makes these findings highly relevant. One of the main findings of this study is that the PSTs mentioned only a few ways of observing and assessing SRL, and out of 118 participants, 18% did not answer the question that targeted this topic. The results do not explain why the PSTs mentioned so few ways of observing and assessing or why so many of the participants skipped the questions on this topic. The authors suggest that this may be partially explained by the fact that the question was challenging for the PSTs, as their responses to this question varied between saying nothing and describing it with practical examples. In the results, most responses were related to observation of the SRL phases, mainly the performance phase. Some of the PSTs listed SRL observation and assessment tools mentioned in prior research, such as learning diaries, self-reports, discussions, interviews, and classroom observations (Boekaerts & Corno, 2005; Heirweg et al., 2019; Karlen, Hirt, et al., 2023; Michalsky, 2017; Zimmerman & Martinez-Pons, 1986). The PSTs also mentioned both offline and online instruments for assessing SRL (Karlen, Hirt, et al., 2023). However, it remained unclear how the PSTs would exactly observe and assess SRL during those phases or with those instruments. Overall, these results are consistent with previous studies which have found that teachers' skills in observing and assessing SRL are quite narrow (Karlen, Hirt, et al., 2023; Michalsky, 2017) and that teachers' ideas of SRL assessment often focus on cues unrelated to SRL, such as students' achievement levels (Dignath & Sprenger, 2020). Further research is urgently needed, as the results suggest that PSTs do not know what to observe from the performance or the self-reflection phases.

6.3. PSTs' methods for supporting SRL

The third research question explored PSTs' views on supporting SRL. The participants did not report as many ways to support SRL as they described SRL at a conceptual level in general. For example, they strongly associated self-control with the concept of SRL but mentioned ways of supporting self-control significantly less often. The same was found for learning strategies and time management; mentions of fluency in learning strategies and time-management skills appeared in their descriptions, but the participants provided significantly fewer mentions of methods to teach or support these. In light of previous studies (Alvi & Gillies, 2018; Dignath & Veenman, 2021; Hattie & Yates, 2014), this lack of ways to support students' SRL in the PSTs' descriptions was expected. However, this study also explored both SRL as a phenomenon and ways to support SRL, and the qualitative differences were explicit. The PSTs did not sufficiently specify ways in which teachers can act to support SRL, even though they noted many types of SRL skills.

However, SRL is a complex concept, and the PSTs covered all SRL phases in their descriptions. The most often named support method was focused on the performance phase and highlighted the creation of a learning environment that could support SRL, which has been noted as one of the methods of promoting SRL (Dignath & Veenman, 2021). The participants also deemed it important to regulate teachers' support, which is likewise seen in the literature as relevant to SRL support (Perry & VandeKamp, 2000). A less frequently mentioned support method was explicit strategy support and teaching SRL strategies during the forethought phase (e.g. teaching the meaning of strategic planning; for what purposes, when, and how to use strategic planning). However, PSTs considered it important for the teacher to motivate and support goal setting, which is noted to be important in SRL support (Alvi & Gillies, 2018; Bakhtiar et al., 2018). Supporting the reflection phase by providing feedback was also an only rarely mentioned support method, as expected, considering previous literature (Bolhuis & Voeten, 2001; Koivuniemi et al., 2021). The PSTs did not mention emotional support, which has been shown to have a positive effect on students' behavioural regulation (Sankalaite et al., 2021), when describing the way teachers can support SRL skills.

The results show that some of the PSTs thought that those with high SRL skills do not need help and can work on their own – co-regulation was less frequently mentioned, although some noted that the intention is not to leave the student alone but to provide support and opportunities to ask for help. This highlights the need to broaden PSTs' perspectives on SRL and to clarify that SRL does not mean leaving students alone and without support. This study also shows that the PSTs did not consider peer-level support or, for example, group activities and socially shared regulation of learning in their responses (Hadwin et al., 2018). These concepts are relevant, as group activities are often utilised in modern education practices and can provide an arena for the development of individual- and group-level SRL skills (Häkkinen et al., 2016).

6.4. Summary of the main findings

To summarise, PSTs reflected all of the SRL phases of Zimmerman's cyclical SRL model (2000) in their responses, highlighting the performance phase and mentioning the reflection phase the least. Although they did recognise many relevant aspects of Zimmerman's model (e.g. motivational aspects, metacognitive monitoring, and self-reflection), the PSTs demonstrated a lack of knowledge of the reflection phase, and the emotional aspects of SRL (Boekaerts, 2011) were missing from their reflections. In addition, the PSTs identified significantly fewer SRL support methods than descriptions of SRL as a phenomenon, and the participants provided even fewer ways of observing the development of students' SRL skills than support methods. Based on these results, it can be concluded that the PSTs could not fully and comprehensively identify the ways in which teachers can support SRL and observe the development of SRL skills.

The current study provides knowledge and details about PSTs' understanding of SRL at a conceptual level as well as their perspectives on pedagogical practices for observing and supporting SRL. Although very few previous studies have explored PSTs' understanding of SRL and their ways of observing or supporting SRL, these findings are mostly comparable with studies of in-service teachers. This study is consistent with previous studies that have shown that SRL support and observation is a challenging issue for teachers (De Smul et al., 2018; Dignath-van Ewijk & van der Werf, 2012; Karlen, Hirt, et al., 2023; Spruce & Bol, 2015) and

for PSTs (Lawson et al., 2019; 2023). Furthermore, it is quite surprising that the findings of the present study of PSTs do not differ significantly from the findings of in-service teachers from previous studies. To promote students' SRL skills, teachers must understand the students' SRL-related needs and strengths by assessing and observing those skills (Karlen et al., 2020, 2023) and by supporting SRL with effective methods (Dignath & Veenman, 2021). The research described in this article makes a significant contribution to the field of teacher professional development and teacher education by providing qualitative details of PSTs' views on understanding, observing, and supporting SRL.

6.5. Limitations

This study used an open-ended questionnaire, and some critical evaluation should be directed at the nature of the data. Limitations of the open-ended questionnaire need to be taken into account when the results are considered at a more general level. For example, would the results be different with interviews or with observational data in real classroom interactions? It is possible that the PSTs possessed a broader understanding of SRL than they indicated in the open-ended questionnaire. Presumably, the PSTs' actual methods of support would be visible to observation or via other additional data collection. However, the participants were not recruited on the basis of a strong interest in SRL, nor were they given any prior information about SRL. Although the results of the study are not fully generalisable due to the nature of the data, these PSTs from four higher education institutions in Finland can be assumed to be quite representative. To develop pedagogical interventions and teacher training curricula, it is necessary to be aware of how PSTs understand the concept of SRL and how they view teachers' abilities to observe and support the development of students' SRL skills.

7. Conclusion

Self-regulated learning is highly relevant to students' learning processes and lifelong learning, and it is crucial that SRL be understood, observed, and supported by teachers (Dignath et al., 2008; Dignath & Veenman, 2021; Karlen, Hirt, et al., 2023). If PSTs and teachers do not know how to observe SRL skills and development in a high-quality and meaningful way, the individuality of SRL support may be lacking. Further research is needed to determine whether PSTs' SRL observation and support skills can be promoted, for example, during classroom practice through post-observation discussions between the PST, teacher educator, and primary school teacher (Lawson et al., 2023; Perry et al., 2008). Moreover, while the participants in this study generally exhibited limited views of SRL, the quality of those views varied significantly. Further research is needed to explore in more detail the quality of participants' responses (see, e.g., Cleary & Callan, 2018). Overall, there is very little research on PSTs' understanding of SRL, and this study highlighted the need to focus on PSTs' skills in observing and supporting students' development of SRL skills. The findings of this study on PSTs' insights into understanding, observing, and supporting SRL are important for the development of teacher education, as teachers have an important role as facilitators in the development of SRL skills in schools.

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CRediT authorship contribution statement

Jenni Latva-aho: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Piia Näykki:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Saara Pyykkönen:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Sirpa Laitinen-Väänänen:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Laura Hirsto:** Writing – review & editing, Methodology, Conceptualization. **Marjaana Veermans:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could appear to have influenced the work reported in this paper.

Data availability

Data will be made available on request.

References

Alvi, E., & Gillies, R. M. (2018). A case study of a grade 7 teacher's perspectives and practices related to self-regulated learning (SRL). *Asia-Pacific Journal of Teacher Education, 48*(2), 147–167. https://doi.org/10.1080/1359866X.2018.1542663

Bakhtiar, A., Webster, E. A., & Hadwin, A. F. (2018). Regulation and socio-emotional interactions in a positive and a negative group climate. *Metacognition and Learning, 13*(1), 57–90. https://doi.org/10.1007/s11409-017-9178-x

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Boekaerts, M. (1995). The interface between intelligence and personality as determinants of classroom learning. In D. H. Saklofske, & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 161–183). Plenum Press. https://doi.org/10.1007/978-1-4757-5571-8_9.

Boekaerts, M. (2011). Emotions, emotion regulation, and self-regulation of learning. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 408–425). Routledge/Taylor & Francis Group.

Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on assessment and intervention. *Applied Psychology, 54*(2), 199–231. https://doi.org/10.1111/j.1464-0597.2005.00205.x

Bolhuis, S., & Voeten, M. J. (2001). Toward self-directed learning in secondary schools: What do teachers do? *Teaching and Teacher Education, 17*(7), 837–855. https://doi.org/10.1016/s0742-051x(01)00034-8

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65*(3), 245–281. https://doi.org/10.2307/1170684

Cleary, T. J., & Platten, P. (2013). Examining the correspondence between self-regulated learning and academic achievement: A case study analysis. *Educational Research International, 2013*, 1–18. https://doi.org/10.1155/2013/272560

de Boer, H., Donker, A. S., Kostons, D. D. N. M., & van der Werf, G. P. C. (2018). Long-term effects of metacognitive strategy instruction on student academic performance: A meta-analysis. *Educational Research Review, 24*, 98–115. https://doi.org/10.1016/j.edurev.2018.03.002

De Ruig, N. J., de Jong, P. F., & Zee, M. (2023). Stimulating elementary school students' self-regulated learning through high-quality interactions and relationships: A narrative review. *Educational Psychology Review, 35*(3), 71. https://doi.org/10.1007/s10648-023-09795-5

De Smul, M., Heirweg, S., Van Keer, H., & Devos, G. (2018). How competent do teachers feel instructing self-regulated learning strategies? Development and validation of the teacher self-efficacy scale to implement self-regulated learning. *Teaching and Teacher Education, 71*, 214–225. https://doi.org/10.1016/j.tate.2018.01.001

Dignath, C., Buettner, G., & Langfeldt, H. (2008). How can primary school students learn self-regulated learning strategies most effectively?: A meta-analysis on self-regulation training programmes. *Educational Research Review, 3*(2), 101–129. https://doi.org/10.1016/j.edurev.2008.02.003

Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning, 3*(3), 231–264. https://doi.org/10.1007/s11409-008-9029-x

Dignath, C., & Büttner, G. (2018). Teachers' direct and indirect promotion of self-regulated learning in primary and secondary school mathematics classes – insights from video-based classroom observations and teacher interviews. *Metacognition and Learning, 13*(2), 127–157. https://doi.org/10.1007/s11409-018-9181-x

Dignath, C., & Sprenger, L. (2020). Can you only diagnose what you know? The relation between teachers' self-regulation of learning concepts and their assessment of students' self-regulation. *Frontiers in Education, 5*, Article 585683. https://doi.org/10.3389/feduc.2020.585683

Dignath, C., & Veenman, M. V. J. (2021). The role of direct strategy instruction and indirect activation of self-regulated learning—evidence from classroom observation studies. *Educational Psychology Review, 33*(2), 489–533. https://doi.org/10.1007/s10648-020-09534-0

Dignath-van Ewijk, C., & van der Werf, G. (2012). What teachers think about self-regulated learning: Investigating teacher beliefs and teacher behavior of enhancing students' self-regulation. *Educational Research International, 2012*, Article 741713. https://doi.org/10.1155/2012/741713

Dörrenbächer-Ulrich, L., Weißenfels, M., Russer, L., & Perels, F. (2021). Multimethod assessment of self-regulated learning in college students: Different methods for different components? *Instructional Science, 49*(1), 137–163. https://doi.org/10.1007/s11251-020-09533-2

Endedijk, M. D., Vermunt, J. D., Verloop, N., & Brekelmans, M. (2012). The nature of student teachers' regulation of learning in teacher education. *British Journal of Educational Psychology, 82*(3), 469–491. https://doi.org/10.1111/j.2044-8279.2011.02040.x

Gan, Z., Liu, F., & Yang, C. C. R. (2020). Student-teachers' self-efficacy for instructing self-regulated learning in the classroom. *Journal of Education for Teaching, 46*(1), 120–123. https://doi.org/10.1080/02607476.2019.1708632

Hadwin, A., Järvelä, S., & Miller, M. (2018). Self-regulation, co-regulation, and shared regulation in collaborative learning environments. In D. H. Schunk, & J. A. Greene (Eds.), *Handbook of self-regulation of learning and performance* (2nd. ed., pp. 83–106). Routledge. https://doi.org/10.4324/9781315697048-6.

Häkkinen, P., Järvelä, S., Mäkitalo-Siegl, K., Ahonen, A., Näykki, P., & Valtonen, T. (2016). Preparing teacher-students for twenty-first-century learning practices (PREP 21): A framework for enhancing collaborative problem-solving and strategic learning skills. *Teachers and Teaching, 23*(1), 25–41. https://doi.org/10.1080/13540602.2016.1203772

Hattie, J. A. C., & Yates, G. C. R. (2014). Using feedback to promote learning. In V. A. Benassi, C. E. Overson, & C. M. Hakala (Eds.), *Applying science of learning in education: Infusing psychological science into the curriculum* (pp. 45–58). Society for the Teaching of Psychology.

Heirweg, S., De Smul, M., Devos, G., & Van Keer, H. (2019). Profiling upper primary school students' self-regulated learning through self-report questionnaires and think-aloud protocol analysis. *Learning and Individual Differences, 70*, 155–168. https://doi.org/10.1016/j.lindif.2019.02.001

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Karlen, Y., Bäuerlein, K., & Brunner, S. (2023). Teachers' assessment of self-regulated learning: Linking professional competences, assessment practices, and judgment accuracy. *Social Psychology of Education*. https://doi.org/10.1007/s11218-023-09845-4

Karlen, Y., Hertel, S., & Hirt, C. N. (2020). Teachers' professional competences in self-regulated learning: An approach to integrate teachers' competences as self-regulated learners and as agents of self-regulated learning in a holistic manner. *Frontiers in Education, 5*. https://doi.org/10.3389/feduc.2020.00159

Karlen, Y., Hirt, C. N., Jud, J., Rosenthal, A., & Eberli, T. D. (2023). Teachers as learners and agents of self-regulated learning: The importance of different teachers' competence aspects for promoting metacognition. *Teaching and Teacher Education, 125*, Article 104055. https://doi.org/10.1016/j.tate.2023.10405

Kistner, S., Rakoczy, K., Otto, B., Dignath-van Ewijk, C., Büttner, G., & Klieme, E. (2010). Promotion of self-regulated learning in classrooms: Investigating frequency, quality, and consequences for student performance. *Metacognition and Learning, 5*(2), 157–171. https://doi.org/10.1007/s11409-010-9055-3

Koivuniemi, M., Järvenoja, H., Järvelä, S., & Thomas, V. (2021). An overview of instruments for assessing and supporting elementary school students' self-regulated learning. *Learning: Research and Practice, 7*(2), 109–146. https://doi.org/10.1080/23735082.2020.1859123

Kostøl, E., & Mänty, K. (2024). Co-regulating the child's emotions in the classroom: Teachers' interpretations of and decision-making in emotional situations. *International Journal of Educational Research, 127*, Article 102390. https://doi.org/10.1016/j.ijer.2024.102390

Kramarski, B. (2018). Teachers as agents in promoting students' SRL and performance. In D. E. Schunk, & J. A. Greene (Eds.), *Handbook of self-regulation of learning and performance* (2nd. ed., pp. 223–240). Routledge.

Kramarski, B., & Kohen, Z. (2017). Promoting preservice teachers' dual self-regulation roles as learners and as teachers: Effects of generic vs. specific prompts. *Metacognition and Learning, 12*(2), 157–191. https://doi.org/10.1007/s11409-016-9164-8

Kramarski, B., & Michalsky, T. (2010). Preparing preservice teachers for self-regulated learning in the context of technological pedagogical content knowledge. *Learning and Instruction, 20*(5), 434–447. https://doi.org/10.1016/j.learninstruc.2009.05.003

Key figures on early childhood and basic education in Finland. In Kumpulainen, T. (Ed.), *Reports and surveys 2018:3*, (2018). Finnish National Agency for Education. https://www.oph.fi/en/statistics-and-publications/publications/key-figures-early-childhood-and-basic-education-finland.

Lawson, M., Van Deur, P., Scott, W., Stephenson, H., Kang, S., Wyra, M., Darmawan, I., Vosniadou, S., Murdoch, C., White, E., & Graham, L. (2023). The levels of cognitive engagement of lesson tasks designed by teacher education students and their use of knowledge of self-regulated learning in explanations for task design. *Teaching and Teacher Education, 125*, Article 104043. https://doi.org/10.1016/j.tate.2023.104043

Lawson, M., Vosniadou, S., Van Deur, P., & Wyra, M. (2019). Teachers' and students' belief systems about the self-regulation of learning. *Educational Psychology Review, 31*, 223–251. https://doi.org/10.1007/s10648-018-9453-7

Lincoln, T. (2021). *Qualitative research*. Atla Open Press.

Lombaerts, K., Engels, N., & Vanderfaeillie, J. (2007). Exploring teachers' actions to promote self-regulated learning practices in primary school. *Australian Educational and Developmental Psychologist, 24*(2), 4–24. https://doi.org/10.1017/s0816512200029187

Michalsky, T. (2017). What teachers know and do about assessing students' self-regulated learning. *Teachers College Record, 119*(13). https://doi.org/10.1177/016146811711901313

Michalsky, T., & Schechter, C. (2013). Preservice teachers' capacity to teach self-regulated learning: Integrating learning from problems and learning from successes. *Teaching and Teacher Education, 30*, 60–73. https://doi.org/10.1016/j.tate.2012.10.009

Montroy, J. J., Bowles, R. P., Skibbe, L. E., McClelland, M. M., & Morrison, F. J. (2016). The development of self-regulation across early childhood. *Developmental Psychology, 52*(11), 1744–1762. https://doi.org/10.1037/dev0000159

Näykki, P., Kontturi, H., Seppänen, V., Impiö, N., & Järvelä, S. (2021). Teachers as learners – a qualitative exploration of pre-service and in-service teachers' continuous learning community OpenDigi. *Journal of Education for Teaching, 47*(4), 495–512. https://doi.org/10.1080/02607476.2021.1904777

Neuendorf, K. A. (2016). *The content analysis guidebook* (2nd ed.). Thousand Oaks: Sage Publications, Inc.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307–332.

Perry, N. E. (1998). Young children's self-regulated learning and contexts that support it. *Journal of Educational Psychology, 90*(4), 715–729. https://doi.org/10.1037/0022-0663.90.4.715

Perry, N. E., Hutchinson, L., & Thauberger, C. (2007). Mentoring student teachers to design and implement literacy tasks that support self-regulated learning and writing. *Reading & Writing Quarterly, 23*, 27–50. https://doi.org/10.1080/10573560600837636

Perry, N. E., Hutchinson, L., & Thauberger, C. (2008). Talking about teaching self-regulated learning: Scaffolding student teachers' development and use of practices that promote self-regulated learning. *International Journal of Educational Research, 47*(2), 97–108. https://doi.org/10.1016/j.ijer.2007.11.010

Perry, N. E., & Rahim, A. (2011). Studying self-regulated learning in classrooms. In B. J. Imerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 122–136). Routledge.

Perry, N. E., & VandeKamp, K. O. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research, 33*, 821–843.

Pino-Pasternak, D., Basilio, M., & Whitebread, D. (2014). Interventions and classroom contexts that promote self-regulated learning: Two intervention studies in United Kingdom primary classrooms. *Psykhe: Revista de la Escuela de Psicología, 23*(2), 1–13. https://doi.org/10.7764/psykhe.23.2.739

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 452–502). Academic Press.

Ruzek, E. A., Hafen, C. A., Allen, J. P., Gregory, A., Mikami, A. Y., & Pianta, R. C. (2016). How teacher emotional support motivates students: The mediating roles of perceived peer relatedness, autonomy support, and competence. *Learning and Instruction, 42*, 95–103. https://doi.org/10.1016/j.learninstruc.2016.01.004

Sankalaite, S., Huizinga, M., Dewandeleer, J., & Xu, C. (2021). Strengthening executive function and self-regulation through teacher-student interaction in preschool and primary school children: A systematic review. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.718262

Schreier. (2012). *Qualitative content analysis in practice*. SAGE Publications Ltd.

Spruce, R., & Bol, L. (2015). Teacher beliefs, knowledge, and practice of self-regulated learning. *Metacognition and Learning, 10*(2), 245–277. https://doi.org/10.1007/s11409-014-9124-0

Taxer, J. L., & Gross, J. J. (2018). Emotion regulation in teachers: The "why" and "how". *Teaching and Teacher Education, 74*, 180–189. https://doi.org/10.1016/j.tate.2018.05.008

Whitebread, D., Coltman, P., Pasternak, D. P., Sangster, C., Grau, V., Almeqdad, B. Q., & Demetriou, D. (2009). The development of two observational tools for assessing metacognition and self-regulated learning in young children. *Metacognition Learning, 4*, 63–85. https://doi.org/10.1007/s11409-008-9033-1

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 277–304). Lawrence Erlbaum Associates Publishers.

Wolters, C. A. (2003). Understanding procrastination from a self-regulated learning perspective. *Journal of Educational Psychology, 95*(1), 179–187. https://doi.org/10.1037/0022-0663.95.1.179

Wolters, C. A. (2011). Regulation of motivation: Contextual and social aspects. *Teachers College Record, 113*, 265–283. https://doi.org/10.1177/016146811111300202

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329–339. https://doi.org/10.1037/0022-0663.81.3.329

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. (2002). Becoming a self-regulated learner. *Theory into Practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning-strategies. *American Educational Research Journal, 23*(4), 614–628. https://doi.org/10.3102/00028312023004614

Zimmerman, B. J., & Moylan, A. R. (2009). Self-regulation: Where metacognition and motivation intersect. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of metacognition in education* (pp. 299–315). Lawrence Erlbaum Associates Publishers.