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The promotion of self-regulated learning in the classroom: a theoretical framework and an observation study

Stella Vosniadou[1] · Erin Bodner[1] · Helen Stephenson[2] · David Jeffries[3] · Michael J. Lawson[1] · IGusti Ngurah Darmawan[4] · Sean Kang[5] · Lorraine Graham[5] · Charlotte Dignath[6]

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Abstract
The paper describes a theoretical framework for the study of teachers' promotion of self-regulated learning in the classroom. The Self-Regulated Learning Teacher Promotion Framework (SRL-TPF) utilizes the ICAP theory to assess the affordances of the learning environment for the indirect promotion of SRL, proposes new variables in the investigation of the direct promotion of SRL, and examines how these two ways to promote SRL are related. The SRL-TPF was used to examine the direct and indirect promotion of SRL in filmed observations of 23 Australian classrooms. The results revealed a paucity in the design of Constructive and Interactive lesson tasks that support the indirect promotion of SRL and a preference for the direct support of SRL through implicit strategy instruction and the provision of metacognitive reflection and support. There were important teacher differences in both the direct and indirect promotion of SRL, but the teachers who were more likely to design Constructive and Interactive lesson tasks did not necessarily promote SRL directly and vice versa. The research contributes to a better understanding of the relationship between teaching what to learn (subject content) and how to learn (SRL knowledge and strategies).

Keywords Self-regulated learning · ICAP · Classroom observations · Teacher professional development

✉ Stella Vosniadou
Stella.Vosniadou@flinders.edu.au

[1] College of Education, Psychology and Social Work, Flinders University, GPO Box 2100, Adelaide, South Australia 5001, Australia

[2] Education Futures, University of South Australia, Adelaide, Australia

[3] Australian Council for Educational Research, Melbourne, Australia

[4] School of Education, the University of Adelaide, Adelaide, Australia

[5] Melbourne Graduate School of Education, The University of Melbourne, Melbourne, Australia

[6] TU Dortmund University, Dortmund, Germany

Introduction

The purpose of the research presented in this paper was to develop a framework for the conceptualization of teachers' promotion of self-regulated learning and use it to investigate SRL teacher promotion practices in classroom observations. This SRL Teacher Promotion Framework (SRL-TPF) brings together two theoretical approaches to the analysis of student learning: Self-Regulated Learning (SRL) (Boekaerts & Cascallar, 2006; Efklides, 2011; Pintrich, 2000; Schunk & Greene, 2017; Winne & Hadwin, 2008; Zimmerman, 2008) and the Interactive, Constructive, Active, Passive (ICAP) theory of student cognitive engagement (Chi & Wylie, 2014; Chi et al., 2018).

SRL theoretical approaches investigate the knowledge and strategies learners use to manage their behavior during learning. There are several distinct models of SRL, but all agee that learning can be improved and that it is more effective when students have the knowledge and strategies required to control their cognition, motivation and emotion (Panadero, 2017). Educational research has provided considerable evidence for the beneficial impact of SRL strategy interventions on student achievement (Boekaerts et al., 2000; Mayer, 2008; McCombs, 2017; Nückles et al., 2012; Perry et al., 2015; Winne, 2011; Zimmerman, 2011). Five meta-analyses have shown that learning strategy interventions that improve students' self-regulation and metacognitive awareness improve learning outcomes (Dignath & Büttner, 2008; Dignath et al., 2008; Donker et al., 2014; Hattie et al., 1996; Sitzmann & Ely, 2011).

Unlike SRL, ICAP is a theory of student cognitive engagement (Chi & Wylie, 2014). It argues that we can distinguish four modes of student cognitive engagement – Interactive, Constructive, Active and Passive – which are associated with different knowledge change processes and different learning outcomes. The Active mode leads to better learning outcomes than the Passive mode because it engages the learner in activities that facilitate the retention of new information. The Constructive mode is better than the Active mode because it encourages activities such as providing explanations, drawing inferences, and raising critical questions that have the potential to generate new knowledge. The Interactive mode is better than the Constructive mode because it is related to co-constructive activities between two or more learners, such as arguing, debating, critiquing, questioning, that can create new knowledge beyond that which each partner could have generated alone.

Like SRL, ICAP is also supported by considerable empirical evidence. This evidence comes from intervention studies by Chi and colleagues and by other researchers who compared student learning outcomes from the same activity in two different engagement modes (e.g., Bauer & Koedinger, 2007; Kam et al., 2005; Peper & Mayer, 1986), or in three or four different engagement modes (e.g., Coleman et al., 1997; Menekse et al., 2013). The results of these studies have confirmed that the engagement mode in which the learning activity takes place influences learning outcomes in the direction predicted by ICAP theory.

Despite their differences in scope, the two frameworks agree that the control of learning lies primarily with learners and on the actions that they take to learn. This emphasis on the substantial degree of learner control of learning should not be interpreted as underplaying the potentially important degree of influence that can be exerted by a teacher. Rather, it is just acknowledging that it is the learners who orchestrate the learning actions they will take, either wholly on their own or using the advice of the teacher or others. Explicit in both the SRL and ICAP frameworks is the view that students' learning actions can be improved and that teachers have an important role to play in doing so. In the context of ICAP teachers help students improve their learning when they design Constructive and

Interactive tasks that require deep learning and critical thinking. In the context of SRL teachers help students learn by teaching them how to manage their learning.

SRL theories distinguish learning actions with respect to the planning, monitoring and management of learning. For example, in Zimmerman's SRL model, learning is conceptualized as a cyclical process, composed of separate and interacting phases – i.e., forethought, performance and self-reflection – and learning actions are differentiated with respect to the learning phases they belong – i.e., planning, monitoring, evaluating (Zimmerman, 2008; Zimmerman & Campillo, 2003; Zimmerman & Kitsantas, 2007). Other SRL theorists propose slightly different phases or subphases and/or focus more on whether learning actions are cognitive, metacognitive, motivational, or affective (Boekaerts & Cascallar, 2006; Efklides, 2011; Pintrich, 2000; Winne & Hadwin, 2008). Winne and Hadwin (2008) propose four recursive SRL phases – task definition, goal setting, enacting study strategies, and metacognitively adapting studying – and explain the cognitive processing that takes place during these phases. Pintrich (2000) focuses on the relationship between SRL and motivation and so does Boekaerts (Boekaerts & Corno, 2005) who examined the role of goals and emotions in self-regulation and described the different volitional and emotion regulation strategies that take place during learning. Finally, the Metacognitive and Affective Model of SRL (Efklides, 2011) focuses on the role of metacognition, motivation and affect. This model distinguishes a top-down process (the Person-level or macrolevel), which is structured around students' goals for the task to guide cognitive processing, and a bottom-up process (the Task X Person or microlevel) during which metacognitive activity guides students' data-driven actions to address the demands of the task.

All SRL theories predict that learning outcomes are better when students have the knowledge and strategies required to manage their cognition, motivation, and affect, thus engaging in more effective planning, monitoring, and evaluation learning. But it is also the case that teachers can help students improve their learning actions when they make explicit the cognitive, metacognitive and motivational processes that take place when they are engaged in constructive tasks and scaffold their learning so that students can become self-regulated. These actions by teachers that stimulate effective SRL in students could be seen as a type of shared social co-regulation of learning as described by Hadwin et al. (2018). The explicit promotion of SRL by the teacher through modeling of an SRL strategy, that could be labelled self-regulated teaching, expands the sphere of SRL action to involve the teacher-student pairing.

Although SRL interventions focus mainly on the enhancement of learning strategies many researchers have argued that it is important to consider the role of tasks and context in the promotion of student self-regulation. According to Paris and Paris (2001) "whether students use self-regulation tactics in school, what kinds of strategies they use, how they are rewarded for their use, and how much effort they expend being regulated and strategic, depends on the tasks and contexts that teachers create for students" (p. 93).

The importance of integrating strategy instruction with learning content has also been highlighted in the results of meta-analytic studies of SRL strategy interventions that show that strategy instruction does not by itself improve strategy use and learning outcomes (Dignath & Büttner, 2008; Dignath & Veenman, 2021; Dignath et al., 2008). Rather, the best learning outcomes are obtained "when strategy training was used metacognitively, with appropriate motivational and contextual support" during the instructional sessions (Hattie et al., 1996, p. 36). Dignath and colleagues have argued that students need to acquire metacognitive knowledge about when and, how a strategy should be used, in which contexts it is best used, and why and, how their learning will benefit from using this strategy (Butler, 2002; Dignath & Veenman, 2021; Schraw, 1998). When such contextual support is provided students are more likely to

use the instructed strategy and transfer it to new settings (see also Efklides, 2011; McCombs & Marzano, 1990).

Cognitive engagement approaches, like ICAP, focus directly on how the nature of academic tasks influence student learning. When the students are engaged in interactive and constructive tasks, they are more likely to be motivated to be metacognitive and to engage in strategic thinking and learning than when classroom instruction offers superficial tasks that can be undertaken with rote learning and memorization. Constructive and interactive tasks offer the best platforms for teachers to externalize, model and scaffold internal learning processes and strategies so that students can understand them and learn how to use them. Indeed, in this respect, SRL and ICAP theoretical approaches are complementary and support each other.

Part of the contextual support for strategy acquisition and use concerns the way a strategy is promoted within lessons and lesson tasks. In a recent review of the literature on classroom observation studies, Dignath and Veenman (2021) distinguished between the direct and indirect promotion of SRL. The direct promotion of SRL happens through explicit or implicit strategy instruction by the teacher. The indirect promotion of SRL, on the other hand, is facilitated when teachers create learning environments that require students to regulate their learning (Dignath & Veenman, 2021). Drawing on prior research by De Corte et al. (2004), Baumert et al. (2010), and Vosniadou et al. (2001), Dignath and Veenman (2021) argued that the learning environments that facilitate the indirect promotion of SRL are constructivist environments, where teachers prompt students to associate new information with prior knowledge, use complex and open problems to that allow multiple solutions, and introduce content information in a meaningful manner. Such environments could include the provision of lesson tasks that require constructive and interactive ICAP levels of engagement and foster the interactive co-construction of knowledge. Similarly, Perry (1998) and Perry and VandeKamp (2000) associated the effective development of SRL in young students with their engagement in complex, meaningful and challenging tasks.

We argue that the ICAP theory can provide a framework for investigating and illuminating the indirect promotion of SRL in the classroom that has certain advantages over prior attempts to define the school learning environments that promote SRL indirectly. More specifically, ICAP: a) distinguishes the generic concept of 'active learning' into four distinct modes of student cognitive engagement; b) provides clear operational criteria for defining these different modes; and c) links the different modes of cognitive engagement to distinct learning processes and outcomes. Furthermore, the ICAP theory has direct and useful implications for SRL interventions in the classroom. For example, according to ICAP, a strategy such as note-taking can result in better learning outcomes if it is used in the context of constructive and interactive tasks compared to active tasks. Thus, the use of the ICAP framework for task design could have beneficial effects for the way that SRL interventions are promoted and delivered in class situations (see Chi & Boucher, 2023; Chi et al., 2023).

In the sections that follow, we review the literature on how teachers can promote SRL in the classroom and describe the SRL Teacher Promotion Framework (TPF).

The role of teachers in the promotion of students' SRL capabilities

Although high school and university students are expected to monitor their learning successfully, many have not developed knowledge about effective ways to learn (Askell-Williams & Lawson, 2015; Askell-Williams et al., 2012; Cleary & Zimmerman, 2004; Elen & Lowyck, 1999; Winne, 2014). Students often have misconceptions about how learning

happens (Bjork et al., 2013), adopt ineffective study strategies that undermine their achievement (e.g., Karpicke, 2009; Kornell & Bjork, 2007), lack metacognitive knowledge about when and how to use their learning strategies effectively (Hartwig & Dunlosky, 2012; McCabe, 2011), or may tend to avoid failure by choosing easy tasks, procrastinating, or avoiding work (Bjork et al., 2013; Dunlosky et al., 2013).

Teachers can play a key role in helping students become self-regulated learners (Azevedo et al., 2008; Hattie, 2011; Paris & Paris, 2001; Perry, 1998), both directly as mentioned earlier, or through the design of appropriate learning environments (Perry & Rahim, 2011; Veenman, 2017). Researchers have studied the role of teachers in assisting students' acquisition of SRL skills using different methodologies. One is the use of quasi-experimental designs that evaluate the impact of SRL interventions. These include studies involving interventions in which teachers are given materials they can use in the classroom to implement strategy training (e.g., Askell-Williams et al., 2012; Perels et al., 2009), or where teachers receive training on how to foster the development of SRL in their students (Kramarski, 2017; Kramarski & Kohen, 2017; Turner, 1995; Xu & Corno, 1998). Well-designed professional development programs have generally been found to improve SRL knowledge and practices in in-service and preservice teachers (Hilden & Pressley, 2007; Kistner et al., 2010; Kramarski & Michalsky, 2009; Perels et al., 2009; Perry et al., 2007; Zohar et al., 2001), although not always (e.g., Veenman & Elshout, 1999). Intervention studies are important because they demonstrate that students' SRL capabilities can be improved, and that this improvement is associated with increases in learning. They do not tell us, however, why teachers are not using this information in their own teaching.

Another research methodology is the use of self-reports to study what teachers know and believe about SRL and about how they promote it. Self-reports provide a great deal of information about teachers' knowledge, beliefs, and perceptions, but they can suffer from validity problems, because teachers might give biased answers for reasons of social desirability, fail to reconstruct their teaching behavior accurately from memory, or because they might hold internally inconsistent beliefs (see Dignath & Veenman, 2021; Veenman & van Cleef, 2019; Vosniadou et al., 2021). These could be some of the reasons why some studies have shown positive correlations between teachers' beliefs and their strategy instruction (e.g., Heirweg et al., 2020) whereas in others no association between teachers' beliefs and practice was found (e.g., Dignath & Büttner, 2018; Karlen et al., 2020; Spruce & Bol, 2015). Classroom observation studies are more difficult to conduct but provide more objective information about what teachers do in the classroom. This information can be a valuable starting point for the design of effective professional development and SRL interventions. The focus of the present research is on classroom observation.

Classroom observation studies that investigate the role of teachers in the promotion of SRL

The work of Perry and her colleagues (Perry, 1998, 2002; Perry & VandeKamp, 2000; Perry et al., 2006, 2015) has provided rich observational information about how teachers can promote SRL in younger students. A qualitative study that presented results from 6-month long observations of writing activities (Perry, 1998) showed that in three of the five observed primary school classrooms (Years 2–3) the teachers provided their students with a learning environment that could promote SRL. For example, they engaged their students in complex, open-ended activities ensuring through appropriate instruction that

the students acquired the domain and strategy knowledge needed to complete these tasks. They also helped children make appropriate choices, encouraged them to attempt challenging tasks, and involved them in evaluating their own and others' work. In contrast, in the remaining two classrooms the teachers engaged the students in simple activities that focused on developing specific skills, avoided presenting challenging tasks, and chose academically ineffective strategies.

Perry and VandeKamp (2000) sought to further refine the features of the teaching and learning environments that promote SRL as they worked collaboratively with five kindergarten- to Grade 3 teachers, helping them to design tasks and types of interactions with students that promote SRL. They distinguished high-and low-SRL environments based on (a) types of tasks (open or closed), (b) types of choice (about what, who, where, when), (c) opportunities to control challenge, (d) opportunities for self-evaluation, (e) support from the teacher (instrumental vs. procedural), (f) support from peers, and (g) teachers' evaluation practices (threatening or not). Classroom observations showed that preservice teachers can be mentored to design and implement such tasks, and, furthermore, that the complexity of these tasks was predictive of students' SRL development (Perry et al., 2006).

Perry's work has investigated the learning environments that support the development of SRL in young children. This type of SRL promotion is *indirect*, compared to the *direct* promotion of SRL, which focuses on the instruction of learning strategies. Dignath and Veenman (2021) reviewed 17 studies published between 1990 and 2019 that used systematic observation methods to investigate teachers' attempts to foster SRL either through indirect promotion (e.g., Perry, 1998; Perry & VandeKamp, 2000), direct strategy instruction (e.g., Depaepe et al., 2010; Hamman et al., 2000; Moely et al., 1992; Spruce & Bol, 2015; Veenman et al., 2009; Zepeda et al., 2019), or through both direct and indirect means (e.g., Dignath & Büttner, 2018; Dignath-van Ewijk et al., 2013; Kistner et al., 2010).

Dignath and her colleagues (Dignath & Büttner, 2018; Dignath et al., 2022; Dignath-van Ewijk et al., 2013) used a structured observation protocol known as the ATES guide (Assessing How Teachers Enhance Self-Regulated Learning—Dignath & Büttner, 2008; Dignath et al., 2008; Dignath-van Ewijk et al., 2013) to code videos of classroom lessons. The ATES guide focused on assessing both the direct and indirect forms of SRL promotion. The indirect forms of SRL strategy promotion were investigated by examining whether the teachers: (a) provided students with freedom of choice over aspects of their learning (self-direction); (b) encouraged cooperative learning; (c) stimulated constructive learning (the teacher activates students' prior knowledge and gives them complex problems); and (d) fostered learning transfer (learning is integrated into real life contexts). Using this system to rate the indirect promotion of SRL in 17 secondary math classrooms, Dignath-van Ewijk et al. (2013) obtained high scores only on the activation of prior knowledge. Using the same instrument, Dignath-van Ewijk et al. (2013) compared primary and secondary school teachers' indirect promotion of SRL in 28 math classrooms. Their results showed that the primary school teachers were more likely to promote constructive and cooperative learning in their students than the secondary school teachers. Kistner et al. (2010), also using the ATES guide, obtained associations between students' achievement and the elements of a learning environment that encouraged constructive learning and transfer but not with the encouragement of freedom of choice or cooperative learning.

To assess direct SRL strategy promotion the ATES guide has examined strategy instruction (i.e., cognitive, metacognitive, and motivational strategies) distinguishing whether strategies were taught in explicit or implicit ways and the manner in which they were taught (see Dignath et al., 2022). Using the ATES guide, Dignath-van Ewijk et al. (2013), Dignath and Büttner (2018), and Kistner et al. (2010) found little or no explicit strategy

instruction overall. The strategy instruction observed was primarily implicit, with a focus on cognitive compared to metacognitive strategies. This contrasts with evidence that students can profit from using metacognitive strategies (Dignath & Büttner, 2018; Hattie & Yates, 2013; Veenman, 2011). The low frequency of metacognitive strategy promotion has been confirmed by other observational studies using protocols different from the ATES guide (e.g., Hamman et al., 2000; Moely et al., 1992; Veenman et al., 2009).

Spruce and Bol (2015) used Zimmerman's (2008) model and Schraw's Metacognitive Checklist (1998) to guide the design of their observation instrument consisting of 18 observable questions under three categories: Planning, Monitoring, and Evaluating. They also investigated teachers' knowledge and beliefs about SRL to better understand how they interact with aspects of classroom practice. Their results showed that the teachers' actions encouraged SRL mostly during the monitoring phase of learning and less frequently during planning and evaluation. They noticed that any reflection observed at the end of learning was related to the content studied and not to the process of how the studying was carried out. While the teachers were good at explaining the actions they took to help students learn, "Yet, none described making these actions a teaching point for learning how to self-regulate for their students" (p. 263). For example, they set goals for their students but did not explain to the students why they set those goals or encouraged them to set their own.

Similarly, in Bolhuis and Voeten's (2001) investigation of process-oriented teaching, the results showed that the teachers were good at giving freedom of choice to their students but did not explicitly teach them how to manage their autonomy. In the classrooms observed in that study the students were found to work independently 40% of the time, but only 5% of the teaching time was spent on the explicit discussion of the processes of acquiring content (e.g., strategy teaching, explaining, giving feedback).

In another observation study, Zepeda et al. (2019) proposed a Metacognitive Support Framework and used it to investigate how teachers in 40 middle school mathematics classrooms provided metacognitive support in their talk. This research involved a re-analysis of video data from the Measures of Effective Teaching Longitudinal Database. Based on a conceptual knowledge mathematics assessment over one school year, the authors selected 20 high-conceptual classrooms and 20 low-conceptual classrooms. The observation instrument did not distinguish explicit from implicit forms of metacognitive strategy instruction, but included some other categories of metacognitive teacher talk that were not included in the ATES guide, such as the support of metacognitive knowledge and the expansiveness of metacognitive support, i.e., whether it was tailored to a specific or set of problems or was domain general. The results showed that about 7% of the teacher-talk recorded related to metacognition overall. Metaconceptual talk occurred more often during whole class activities than during group or individual activities. When compared to the low-conceptual growth classrooms, the teachers in the high-conceptual growth classrooms made more personal knowledge, monitoring, evaluating, directive, and domain-general metacognitive statements. The authors concluded that metacognitive talk, especially metacognitive talk related to personal knowledge that supports monitoring and evaluating and facilitates metacognitive processing, has a positive effect on students' conceptual growth.

To summarize, regarding the direct promotion of SRL, teachers have been found to spend little time on strategy instruction overall and especially on teaching strategies explicitly (e.g., Depaepe et al., 2010; Dignath & Büttner, 2018; Dignath-van Ewijk et al., 2013; Spruce & Bol, 2015). When explicit strategy promotion does occur, the emphasis is on cognitive strategies, with little attention to the explicit teaching of metacognitive strategies (Depaepe et al., 2010; Dignath & Veenman, 2021; Spruce & Bol, 2015; Zepeda et al., 2019).

The results of the observation studies regarding the indirect promotion of SRL are less clear, which may be due to the lack of general agreement as to the features of a learning environment that can be used as an index of indirect SRL promotion and the absence of a structured observation protocol to record them. Perry and her colleagues' work revealed that encouraging open-ended, complex tasks under the guidance of teachers is a critical feature of high SRL classrooms. The work of Dignath and her colleagues using the ATES guide showed overall low scores for the indirect promotion of SRL, except for the activation of prior knowledge (Dignath-van Ewijk & van der Werf, 2012) and cooperative learning (see also Michalsky & Schechter, 2013) especially for primary school classrooms. Relations with student learning gains have been found between constructivist elements of a learning environment and elements that foster transfer (Kistner et al., 2010), but not with the use of self-directed independent learning (Kistner et al., 2010; Lau, 2012).

There is little information regarding relationships between the direct and indirect promotion of SRL. Pauli et al. (2007) examined how "surface features of instruction that foster self-regulated learning" and those "that focus on higher-order thinking, problem-solving, and mathematical modeling" (p. 294) are related in 79 eight-grade math classrooms in Switzerland. The results showed that the teachers implemented these two instructional approaches independently of one another, and that teachers' constructivist beliefs influenced only the opportunities teachers provided to students for independent learning.

In conclusion, classroom observation studies have highlighted the need for a) more structured and less high inference approaches to investigate the indirect promotion of SRL, b) an expanded framework for the conceptualization of the direct promotion of SRL that includes factors such as the promotion of students' knowledge about SRL and support of metacognition, and c) better understanding of how indirect and direct ways of promoting SRL are related to each other. The SRL-TPF is designed to address all three issues.

The present study

The research developed the SRL Teacher Promotion Framework (SRL-TPF) and used it to develop two observation protocols that investigated teachers' direct and indirect promotion of SRL in the transcripts of filmed observations in 23 Australian classrooms.

Indirect promotion of SRL

The SRL-TPF used the distinctions between Passive, Active, Constructive, and Interactive modes of student engagement in the ICAP theory to evaluate the opportunities the classroom learning environment provided for the indirect promotion of SRL. The focus was on the examination of teachers' lesson tasks. Lesson tasks are of considerable theoretical and practical importance because they represent the main agency of the teacher to influence student learning (Watson & Ohtani, 2015). Teachers' design and implementation of tasks and activities is considered a fundamental aspect of teachers' pedagogical knowledge and has been found to be predictive of student knowledge gains in mathematics (Baumert et al., 2010). The SRL-TPF paid particular attention to lesson tasks allowing students to engage in constructive and collaborative activities that challenged them, required conceptual understanding, and provided opportunities for them to practice their self-regulated learning. The encouragement of open-ended, complex and challenging tasks has been found

to be a critical characteristic of classrooms that support the development of SRL (Perry, 1998; Perry & VandeKamp, 2000).

The ICAP theory does not investigate whether teachers give their students some independence to determine their learning activity. However, student self-determination is an important characteristic of a classroom environment that provides opportunities for self-regulation (Dignath & Veenman, 2021; Perry, 1998; Perry & VandeKamp, 2000). It was therefore included in the SRL-TPF as an important characteristic of the learning environment that encourages the indirect promotion of SRL.

Direct promotion of SRL

To investigate teachers' direct promotion of SRL in the classroom the SRL-TPF used a modification of the framework proposed by Dignath and Veenman (2021) and the ATES guide (Dignath & Büttner, 2018; Dignath et al., 2022; Dignath-van Ewijk et al., 2013). The ATES guide examines explicit and implicit strategy instruction, identifies cognitive, metacognitive and motivational SRL strategies, differentiates the manner of SRL strategy promotion, and identifies statements about the benefit of strategy use. The SRL-TPF adopted the above-mentioned criteria, and, in addition a) introduced three new SRL direct promotion types, namely, the promotion of knowledge and beliefs about learning, metacognitive reflection and metacognitive support; b) investigated whether the strategies and knowledge being promoted were domain general or domain specific; and c) examined additional SRL capabilities such as affective capabilities and resource management.

An overview of the SRL-TPF direct promotion is presented in Table 1.

Explicit strategy instruction was recognized when teachers made their intention to teach a strategy clear to students and described the strategy in detail, using the word 'strategy' or providing a name for it. It is important for teachers to name the strategy they teach because this helps students attend to the details of the strategy, remember it, and transfer its use to other situations (Brown et al., 1981; Dignath & Büttner, 2018; Veenman, 2013). *Implicit strategy instruction* involved the instruction of a procedure without using the word strategy to describe it or without naming or identifying it as a strategy. In these cases, the teacher is not explicitly making students aware of the strategy.

An important way in which teachers can improve students' SRL capabilities is by providing them with information about how learning happens and about the importance of having a large repertoire of learning strategies; in other words, by promoting students' SRL related *knowledge*. Teachers can also help students become more aware of the *beliefs* they have about learning and about how their beliefs influence their learning

Table 1 The SRL-TPF—direct promotion categories

SRL promotion types	SRL capabilities	Domain	Manner of promotion	Benefit of use
Explicit strategy instruction	Cognitive	General	Direct verbal	Explanation (Content)
Implicit strategy instruction	Metacognitive	Specific	Modelling	Explanation (Benefit)
Knowledge/beliefs promotion	Motivational		Prompting	Transfer
Metacognitive reflection	Affective			None
Metacognitive support	Resource management			

processes (Vosniadou et al., 2020). Talking to students about mathematics anxiety, for example, can help them understand what such anxiety is and how it influences mathematics performance. It might also help them to better understand some of their own negative academic emotions and to find ways to control them (Carey et al., 2019; Szucs & Mammarella, 2020).

Meta-analytic research has shown larger effects for strategy training when students are aware of the strategies they use and of when and how to use them (Dignath & Veenman, 2021). Such metacognitive awareness is promoted through metacognitive strategy instruction, but also by developing students' metacognitive reflection and by providing metacognitive support. The SRL-TPF examined these two additional types of SRL promotion. *Metacognitive reflection* happens when teachers encourage students to reflect on their knowledge and/or strategies (Brown, 1987; Schraw, 1998; Schraw & Moshman, 1995; Zepeda & Nokes-Malach, 2021), by using statements, like "Stop for a moment and think about what you are doing. Do you understand? *Metacognitive Support* is provided when teachers remind students of their existing knowledge or strategies that may be relevant in the present context, or prompt them to use this knowledge For example, the teacher statement "Before you solve these problems, think about the different problem-solving strategies we have discussed" does not provide explicit or implicit strategy instruction but encourages students to think of specific strategies mentioned in previous lessons that might help them in the current task. Despite the findings of meta-analytic research on the importance of metacognitive reflection (Dignath & Büttner, 2008; Dignath et al., 2008; Hattie et al., 1996), its promotion has not been previously included in frameworks that investigate the direct promotion of SRL, although it has been included in observation protocols that investigate support of metacognition (Zepeda & Nokes-Malach, 2021).

The SRL TPF also examined whether the strategies or knowledge being promoted were *domain general* or *domain specific.* Knowledge and strategies are domain specific when they are helpful in one subject area but not in another. For example, knowledge about how to subtract or divide is useful in mathematics but not in English, as opposed to information and strategies about how to plan an essay, which might be helpful in English but not mathematics. Domain-specific learning strategies were included in the present framework because their explicit promotion has been associated with learning gains in the subject areas (Brown et al., 1981; Dignath et al., 2008). However, they are not intrinsically related to SRL the way domain general learning strategies are. Strategies are domain general when they span across different subject disciplines.

All SRL theories examine the metacognitive and cognitive processing that takes place during the various phases of self-regulation. Some theories also propose a major role for motivational and affective factors (Boekaerts & Corno, 2005; Efklides, 2011; Pintrich, 2000). The ATES guide investigates c*ognitive, metacognitive and motivational* SRL capabilities. The SRL-TPF also investigated these capabilities and added *affective* and r*esource management capabilities. Affective capabilities* refer to knowledge about the feelings and emotions that can emerge from one's actions and how to control them. Knowledge about emotions can help students understand how their performance is affected by their emotional states (Butler & Cartier, 2018; Rao & Gibson, 2019; Sweller et al., 2019). *Resource management* capabilities refer to knowledge, beliefs, and strategies about how to organize the physical and social environment to maximize learning (Pintrich, 2000). These capabilities can involve knowledge about how to find a quiet place to study and avoid distractions, or strategies that can help learners obtain teacher, parent or peer assistance when confused about a task (e.g., Vandevelde et al., 2013).

Observation method and protocols

The observation method was based on the detailed, minute-by-minute analysis of teacher and student talk and action from the transcripts of the filmed lessons. The lesson transcripts together with the videos, provided detailed information about what the teachers and students said and did and of the context in which their interactions took place. In other words, the perspective taken was that of a situative view of SRL, based not on what the teachers or students said or did in isolation, but on their interactions in the classroom context (Greeno, 2006, 2011; Zepeda & Nokes-Malach, 2021). Thus, the observation method provided crucial information about the nature of the learning environment, which is a key indicator of indirect SRL promotion.

The observation protocol for the indirect promotion of SRL was an ICAP-based coding guide – the ICAP-CG – developed in prior work (Vosniadou et al., 2023). The ICAP-CG was used to examine the transcripts of the filmed lessons on a minute-by-minute basis and to identify the lesson tasks. Once the lesson tasks were identified, the ICAP-CG was used to determine the cognitive engagement mode they promoted by examining the instructions the teachers gave to the students about how to execute these tasks.

The observation protocol for the direct promotion was derived from the SRL-TPF direct promotion categories described in Table 1. It examined each teacher utterance in the context in which it occurred to determine whether it included any of the SRL promotion types investigated. If the utterance was categorized as an instance of an SRL promotion type, it was further examined to determine whether the promotion was domain specific or domain general, which SRL capability it promoted, what was the manner of promotion, and whether the teacher mentioned the benefits of the use of the strategy.

Research questions

The following research questions guided the project:

(1) What types of direct and indirect SRL promotion occurred in the talk and action of the teachers as revealed in transcripts of the filmed observations, and what was their frequency of occurrence?
(2) What were the relations and patterns of interaction among indirect and direct SRL promotion types?
(3) Did teachers differ in their direct and indirect promotion of SRL and if so, how? Were the teachers who were more likely to promote SRL directly also likely to promote SRL indirectly and vice-versa?

Method

Participants

The participants were 23 teachers (14 female and nine male) from nine schools, eight of them in the Greater Adelaide region of South Australia and one of them in the eastern suburbs of Melbourne, Victoria. All but one taught in secondary schools (Year 7 to 12), the

exception being a Year 1/2 class, and all but four taught in public schools. The teachers were between 24 and 58 years of age ($M = 38.52$), with 16 of them having more than 5 years of teaching experience. Five teachers had completed a Master level degree; the others had Bachelor level degrees.

Most participants were teaching classes broadly classified as STEM subjects. Five teachers taught Mathematics lessons, 10 taught Hard Sciences (including Physics, Biology, Science, and Aviation), and eight taught Soft Science lessons (including Health, Psychology, Product Innovation, Food Technology, Sustainable Futures, and Entrepreneurism). There was one English teacher and one who taught primary school. 19 teachers came from More Advantaged schools (with 5–7 on Index of Disadvantage based on the South Australian Department for Education) and four from Less Advantaged schools (with 4 on the Index of Disadvantage).

Approval for the research was granted by the Human Research Ethics Committees of Flinders University, The University of Melbourne, and the Department for Education of South Australia.

Procedure

A letter was sent to the principals of schools explaining the purpose of the study and asking permission to recruit interested teachers. If the principal gave permission, the researchers sent a letter to all teachers at the school providing information about the study and asking them to participate. They were informed that participation was entirely voluntary and were assured of anonymity. The teachers who expressed interest signed a consent letter, completed a survey and arranged to have one of their lessons filmed. Seven of the participating teachers did their own filming. The teachers wore lapel microphones during filming so researchers could hear their voice during both whole-class instruction and when they circulated during students' work time.

Materials

Five of the filmed lessons were transcribed by two of the researchers independently. In addition to teacher and student talk, the transcriptions included information about the teacher and student actions necessary to understand the context in which discourse took place. After discussing all differences and agreeing on a common transcription protocol, the remaining videos were transcribed by one researcher. Given differences in the length of the filmed lessons, the decision was made to code the first 40 min of each lesson wherever possible, though there were two lessons shorter than 40 min (one with 38 min, and one with only 20 min available). The transcripts from each lesson were pasted into a coding template on an Excel spreadsheet that the researchers used to complete the coding. There were timestamps showing each minute, so the duration of each relevant lesson event could be determined.

Coding of the lesson transcripts

Indirect SRL promotion—ICAP-CG

Table 2 describes the ICAP-CG used to examine the indirect promotion of SRL. In addition to the four modes of engagement identified in the ICAP framework, a fifth code representing an Active/Collaborative mode of engagement was added. The Active/Collaborative

category was introduced to code the instances where teachers asked students to work together but used verbs in their instructions that belonged to the Active and not the Constructive or Interactive engagement modes.

The coders viewed the filmed lesson, read the lesson transcript, and then determined the lesson tasks. A task was broadly defined as one activity or instance of instructional focus. The coders marked the beginning of each task and its end and proceeded to determine the task engagement code for the teacher and for the students.

Determining the task engagement code for teachers and students Each task was broken down into 1-min units. During any given minute, all the verbs the teacher used to introduce or describe the task when addressing the whole class were highlighted and were used to determine the engagement code (See Table 2).

ICAP codes were also assigned to the students to indicate the dominant mode of engagement *displayed* by most of the students for each minute. The students were assumed to engage in the tasks as described by the teachers' instructions. Thus, the verbs from the teacher instructions were used to determine the student engagement code for each minute. If the transcript indicated a *discrepancy* between teacher instructions and student activity, the student code was based on the description of student activity displayed.

Overall teacher and student engagement codes The overall teacher and student engagement codes for each task were determined by adding the codes for each minute of the task and assigning the most frequent code to the overall task. The teacher and student overall task codes were in some cases different, if there were enough minutes observed of students displaying behavior in a code different from that described in the teacher task instructions or being *off task* (thus Passive). For example, if a task had three Active and five Constructive minutes, the overall teacher task engagement code would be Constructive. If, however, the students were categorized to have five Active and three Constructive minutes, then the overall student task engagement code would be Active. If there were an equal number of minutes from two different codes, the code representing the *higher* mode of engagement was assigned.

Indirect SRL promotion—student self-determination

The 23 lesson transcripts were checked to find examples of teachers giving students some choice over their learning. We distinguished three possible levels of student self-determination:

(1) No instance of student self-determination in the transcript,
(2) Cases where the teachers gave students *minor* choice over their learning, but these choices were rather practical and had tenuous links to learning, and
(3) Cases where the teachers gave students *major* choice over the task-related content in their learning.

Direct SRL promotion

All teacher utterances determined to be instances of an SRL promotion type were coded for the SRL promotion type to which they belonged. Each utterance was then coded

Table 2 The SRL-TPF—indirect promotion assessment using the ICAP-CG

Engagement mode	Teacher actions and talk	Student actions and talk
Passive		
Learners are oriented toward and receive information from the instructional materials without overtly doing anything else related to learning.	Teachers do not give students any directions about how to act, or they may ask the students to: Engage, Go through, Listen, Look, Observe, Read.	Students engage in one or more of the following activities: Reading a text silently, watching a video, or listening to an online lecture without undertaking any other visible activities.
Active		
Requires some form of motoric behaviors that require focused attention.	Teachers instruct students to act on the given information, such as: Add, Annotate, Break down, Calculate, Categorise, Check, Choose, Circle, Click, Complete, Copy, Cover, Cross out, Delete, Describe, Expand, Fill in/out, Find, Fold, Guess, Identify, Include, Keep notes, Label, List, Match, Measure, Move, Name, Number, Order, Paraphrase, Pick, Place, Plot, Practise, Re-organise, Recall, Record, Refer to, Review, Round to, Show, Type, Use, etc.	Students engage in one or more of the following activities: Pointing to, gesturing, rewinding, repeating, re-reading, choosing, highlighting, underlining, copying verbatim notes, mixing chemical amounts, etc.
Constructive		
Requires that the students produce additional externalized outputs, beyond what was provided in the learning materials. It requires the generation of new ideas that go beyond the information given.	Teachers instruct students to engage in activities that can generate new information, in addition to that given in the lesson. Teachers may ask the students to: Ask Questions, Brainstorm, Build, Come up, Comment, Compare, Connect, Construct, Create, Decide, Defend, Determine, Draw, Explain, Generate, Graph, Justify, Plot, Predict, Put/explain/write in own words, Represent, Set goal, Sketch, Solve, State, Suggest, Summarise, Support, etc.	Students engage in one or more activities such as the ones that follow: Drawing a concept map, taking notes in one's own words, asking questions, comparing cases, integrating two texts, or integrating text and diagrams, making plans, inducing hypotheses and causal relations, drawing analogies, generating predictions, reflecting and monitoring one's understanding, self-explaining.
Interactive		
Requires collaboration that meets two criteria:(a) Both partners' utterances must be primarily Constructive; and (b) the interaction can generate new knowledge beyond what each partner could produce alone	Teachers instruct students to interact in the context of a constructive task. Teachers may ask the students to: Agree upon, Answer with partner, Debate, Discuss, Exchange, Help, Participate, Share, Work with group/partner.	Students work with other students in a constructive task. They engage in some of the following actions: Defending and arguing a position, criticizing each other by requesting justification, asking and answering each other's questions, explaining to each other, and elaborating on each other's contributions (such as clarifying, building upon, correcting, etc.).

again for the Capabilities being promoted, the Manner of Promotion, Benefit of Use, and as to whether it was Domain General or Domain Specific (Table 3).

Coding reliability

Four researchers coded six of the lesson transcripts, assigning SRL and ICAP codes based on the SRL TPF. They discussed differences and refined the coding guides when necessary. When all disagreements were resolved, two researchers coded ten of the remaining lesson transcripts independently. Assessment of inter-rater reliability resulted in 84% level of agreement between the two coders and a Cohen's Kappa of 0.68 for the direct promotion of SRL, and 93% level of agreement and Cohen's Kappa of 0.86 for the indirect promotion of SRL (ICAP). Final coding of the remaining 7 transcripts was undertaken by one researcher.

Results

Types of direct and indirect SRL promotion and their frequency

Indirect SRL promotion – ICAP-CG

ICAP-CG task engagement codes We identified 107 lesson tasks in the entire sample. The range of lesson tasks identified in each observation was from one to eight, but 62% of the teachers used between five to seven lesson tasks. Only 26% of these tasks involved stimulation of Constructive and Interactive student cognitive engagement. The remaining 74% of lesson tasks involved Passive, Active or Active/Collaborative engagement (Table 4).

In most cases, the same ICAP codes were assigned to the teachers and the students, indicating that the teachers succeeded in engaging the students as they intended. Some differences were observed in the case of Constructive tasks when the students became disengaged (and therefore were in the Passive mode), engaged with the task in the Active mode or collaborated with their peers even though the teacher had not instructed them to do so (Interactive mode).

Minutes of engagement in each code Task duration differed and could last from a few minutes to the entire observation time. Engagement codes were assigned to each minute of observation time, so a task which was given, for example, the engagement code Constructive could include some minutes in other codes. To obtain a more accurate picture of the teacher/student engagement we examined the engagement codes assigned to the teachers and the students for the entire 898 min of observation time (see Table 5). The teachers were assigned 612 min or 67% of the total observation time in the Passive and Active engagement codes and 279 min, or 31% of the total observation time in the combined Constructive and Interactive codes. The profile for the time spent in each mode by students was closely similar.

Table 3 The SRL-TPF—direct promotion assessment

SRL promotion types	SRL capabilities	Manner of promotion	Benefit of use	Framing
Explicit strategy: A strategy is explicitly taught using the word 'strategy' or naming the strategy Implicit strategy: A strategy or procedure is taught without using the word strategy or naming it Knowledge/Beliefs Information is provided about the nature or processes of learning and/or about personal beliefs and their impact on academic performance Metacognitive Reflection: Students are asked to reflect on, monitor or evaluate their learning Metacognitive Support: Students are asked to remember and use relevant information or learning strategies	Cognitive: Promotion related to processes related to learning, such as attention, task analysis, rehearsal, retrieval, imagery, knowledge storage, elaboration, organization, and problem solving. Metacognitive: Promotion related to learners' knowledge and control of their cognition, such as planning, prediction, monitoring, evaluation. Motivational: Promotion related to what stimulates a person to act to achieve a desired goal, such as goal setting, interest, self-efficacy, attributions, rewards. Affective: Promotion related to feelings and emotions, such as anxiety, excitement, anger, embarrassment, and their impact on learning. Resource management: Promotion related to ways of organizing the physical space, or the social environment, such as collaboration, seeking help from others, avoiding distractions	Direct verbal: Teacher tells students something directly Modeling Teacher shows students how to do something (often with verbal instructions as well) Prompting Teacher provides a hint, cue, or encouragement, or asks a question	Explanation content: Teacher explains the benefit of the strategy or knowledge to support student understanding of subject content. Explanation benefit: Teacher explains the benefit in terms of learning gains (helps you remember better) Transfer: Teacher mentions other subjects, tasks, where students could apply the strategy or knowledge	General: Promotion related to several subject areas Specific: Promotion related to specific subject areas

Table 4 Frequency and percent of the task engagement codes assigned to the participating teachers and students

Mode of engagement	Teachers	Students
Passive	39 (36.4%)	42 (39.3%)
Active	39 (36.4%)	37 (34.6%)
Active/Collaborative	1 (0.9%)	2 (1.9%)
Constructive	16 (15.0%)	11 (10.3%)
Interactive	12 (11.2%)	15 (14.0%)
Total	107	107

Table 5 Frequency and percent of time (minutes) the teachers and students were assigned the different engagement codes

ICAP code	Minutes	
	Teachers	Students
Passive	295 (32.9%)	317 (35.3%)
Active	317 (35.3%)	300 (33.4%)
Collaborative	7 (0.8%)	11 (1.2%)
Constructive	167 (18.6%)	140 (15.6%)
Interactive	112 (12.5%)	130 (14.5%)
Total	898	898

Table 6 Student self-determination highest score per task by teacher task engagement code

Task code (teacher)	Frequency of student self-determination		
	No choices	Minor choices	Major choices
Passive ($n=39$)	36 (92.3%)	3 (7.7%)	0 (0%)
Active ($n=39$)	29 (74.4%)	7 (17.9%)	3 (7.7%)
Collaborative ($n=1$)	0 (0%)	1 (100%)	0 (0%)
Constructive ($n=16$)	9 (56.3%)	3 (18.8%)	4 (25.0%)
Interactive ($n=12$)	4 (33.3%)	7 (58.3%)	1 (8.3%)

Indirect SRL promotion – student self-determination (SSD)

The teachers gave the students some opportunities to determine aspects of their learning in 29 out of the 78 tasks (Table 6). In most of these cases (21) the students were allowed to make only minor choices about their learning (e.g., where to sit or with whom to work), compared to major choices that were relevant to learning (e.g., deciding the topic of their project). Frequency of student self-determination was higher during Active, Constructive and Interactive tasks compared to Passive tasks.

Direct SRL promotion

A total of 1,126 instances of direct SRL promotion were identified. They ranged from 17 to 80 instances per teacher with a mean of 50. The most frequent SRL direct promotion types were implicit strategy, metacognitive support, and metacognitive reflection, with the frequency of each of these being around 30%. Only 3.4% of the instances of direct strategy

promotion involved explicit strategy promotion. Just 6% of direct strategy promotions involved the promotion of knowledge/beliefs about learning (Table 7).

The most common SRL capability promoted was cognitive (56.1%), followed by metacognitive (22%) and motivational (14.2%). There were a few instances of resource management promotion and just two instances of the promotion of affective capabilities. Most of the instances of promotion were domain general and the manner was direct verbal. In three-quarters of the instances of direct strategy promotion there was no mention of benefit of use. When teachers did provide explanations, they mostly focused on explaining the subject content being taught rather than the benefit of the strategy, and very few mentioned how the strategy being promoted could transfer to different situations.

Table 8 provides detailed information about the combination of capabilities, domain of reference, manner of promotion, and indication of benefit for each SRL promotion type. Focusing on the teaching of *explicit strategies* we see that 85.5% of the total 38 instances observed referred to cognitive capabilities and 81.6% were domain-specific, an important difference from all other promotion types, which tended to be domain-general. The manner of promotion of an explicit strategy was usually direct verbal with a relatively high proportion of benefit of use (34%). The most common combinations of explicit strategy promotion were *cognitive, domain specific, direct verbal*—followed closely by *cognitive, domain specific, modeling* (76% combined). Table 9 provides examples of the most common combinations of SRL promotion types.

Table 7 Frequency and percent instances of direct SRL promotion categories ($N = 1{,}126$)

SRL category	*n*	%
Promotion type		
Explicit strategy	38	3.4
Implicit strategy	352	31.3
Knowledge/beliefs	68	6.0
Metacognitive reflection	324	28.8
Metacognitive support	344	30.6
Capabilities		
Cognitive	632	56.1
Metacognitive	248	22.0
Motivational	160	14.2
Affective	2	0.2
Resource management	84	7.5
Domain		
General	886	78.7
Specific	240	21.3
Manner of promotion		
Direct verbal	628	55.8
Modelling	50	4.4
Prompting	448	39.8
Benefit of use		
Explanation: content	158	14.0
Explanation: benefit	118	10.5
Transfer	5	0.4
None	845	75.0

Table 8 Frequency and percentage of SRL capabilities, domain, manner of promotion, and benefit of use for the five types of SRL promotion

	Explicit $N=38$		Implicit $N=352$		Knowledge/ beliefs $N=68$		Metacognitive reflection $N=328$		Metacognitive support $N=344$	
	F	%	F	%	F	%	F	%	F	%
Capabilities										
Cognitive	34	89.5	226	64.2	29	42.6	158	48.8	185	53.8
Metacognitive	1	2.6	51	14.5	22	32.4	164	50.6	10	2.9
Motivational	1	2.6	4	1.1	16	23.5	0	0.0	139	40.4
Affective	0	0.0	0	0.0	1	1.5	1	0.3	0	0.0
Resources management	2	5.3	71	20.2	0	0.0	1	0.3	10	2.9
Domain										
General	7	18.4	264	75.0	56	82.4	262	80.9	297	86.3
Specific	31	81.6	88	25.0	12	17.6	62	19.1	47	13.7
Manner										
Direct verbal	23	60.5	289	81.2	66	97.0	23	7.1	227	66.0
Modelling	14	36.8	34	9.7	0	0.0	1	0.3	1	0.3
Prompting	1	2.6	29	8.2	2	2.9	300	92.6	116	33.7
Benefit of use										
Explanation: content	6	15.8	30	8.5	11	16.2	8	2.5	20	5.8
Explanation: benefit	6	15.8	46	13.1	13	19.1	1	0.3	18	5.2
Transfer	1	2.6	3	0.9	0	0.0	0	0.0	1	0.3
None	25	65.8	273	77.6	44	64.7	315	97.2	305	88.7

The teaching of *implicit strategies* (352 instances) targeted cognitive but also metacognitive capabilities and resource management. Most combinations of implicit promotion were domain general with little mention of benefit of use. The most frequent combination (and the third most common combination in the entire sample), was *implicit strategy, cognitive, general, direct verbal.*

The 68 instances of *knowledge/beliefs* promotion observed addressed mainly cognitive, but also referred to metacognitive and motivational capabilities. Most examples were domain-general, and the manner of promotion was almost always direct verbal. In 35% of the instances there was mention of benefit of use, explaining either content or benefit of strategy use.

Both *metacognitive reflection* and *metacognitive support* targeted cognitive capabilities. They differed from each other however, in that metacognitive reflection also targeted metacognitive capabilities using prompting as the manner of promotion, whereas metacognitive support targeted motivational capabilities using direct verbal instruction. The most common combination for metacognitive reflection was *metacognitive reflection, metacognitive, domain-general, prompting.* This combination was the most common in the whole sample, applied to statements such as, "does that make sense?" (spoken by multiple teachers during their lessons). The most common combination for metacognitive support – and the second most common combination in the whole sample – involved the motivational capability: *metacognitive support, motivational, domain general, direct verbal.*

Table 9 Examples from the most common combinations of SRL promotion types

Explicit strategy	Example 1: Explicit strategy, cognitive, domain specific, modelling. "Do you remember what the cosine rule is? […] I'm following this side over here, so it's 600 squared [writes on whiteboard] plus 1600 squared, take 2 lots of 1600, cosine of the angle, and you work that on your calculator." (Teacher 21) Example 2: Explicit strategy, cognitive, domain general, direct verbal, with transfer. "So, before we start, I want to activate your prior knowledge [pointing at own head]. Who can remind us—now remember […] talking about this as one of our reading strategies, who can tell […] what 'activate our prior knowledge' means? […] So it's information that you already know […] I'm going to get you to activate your prior knowledge and […] I want you to write what you know about water." (Teacher 19)
Implicit strategy	Example 1: Implicit strategy, cognitive, domain general, direct verbal. "Okay, take it [the trial exam] seriously, pretend it's the real thing. Give your brain the practice it needs and deserves to do a trial, to do an exam." (Teacher 9) Example 2: Implicit strategy, resource management, domain general, direct verbal. "But if you have a go at them and if you need some help, then either help each other or ask for some help." (Teacher 21)
Knowledge / beliefs	Example 1: Knowledge/beliefs, metacognitive, domain general, direct verbal. "So, what I would like to start off right now is […] our term calendar, our schedule. Getting our feet back into knowing where we are in the stream of time. Where have we been, and how much further do we have to go?" (Teacher 9) Example 2: Knowledge/beliefs, cognitive, domain general, direct verbal, with explanations (both content and benefit). "Look, the boxes are there, and not because I want you to draw boxes every time, but in your head as you get more familiar with this, and like fluent in it, you'll picture those boxes and start piecing the bits together […] Then you won't have to write them all the time […] but the boxes help structure that kind of information, so that's good." (Teacher 18)
Metacognitive reflection	Example 1: Metacognitive reflection, metacognitive, domain general, prompting. "How will you know if you got it right?" (Teacher 16) Example 2: Metacognitive reflection, metacognitive, domain specific, prompting. "Have a think about this one. […] What pattern can we see? Linking our X and Y values together? [Pause.] Just give you a few minutes to think. […] Thinking about […] we want to end up with Y equals something." (Teacher 22)
Metacognitive support	Example 1: Metacognitive support, motivational, domain general, direct verbal. "You're right, I think that's a really good example." (Teacher 13) Example 2: Metacognitive support, cognitive, domain general, prompting. "So, you were researching something about this, if you remember, in the last few sessions. […] So, do you remember, what do they form once they combine together?" (Teacher 3)

Correlations and patterns of interaction between the indirect and direct types of SRL promotion

Correlations

We examined the correlations between direct and indirect SRL promotion types using ICAP and self-determination (SSD) scores as measures of indirect promotion, and an SRL score as measure of direct promotion of SRL. The ICAP score was calculated based on the minutes of Constructive and Interactive tasks in each classroom, while the SSD score was based on the frequency of student self-determination instances in each

observation. The SRL score was calculated based on the total instances of direct teacher SRL promotion observed for each classroom. The results showed no statistically significant correlations among the three variables.

Patterns of interaction

We investigated the patterns of interaction among the indirect and direct forms of SRL promotion by examining the frequency of the different SRL promotion types during each of the four ICAP engagement modes. As mentioned earlier, the assignment of an ICAP engagement code was based on the verbs the teachers used in their utterances during each 1-min unit of instruction time. Unlike ICAP, the coding of which was based on the 1-min unit, the unit for SRL coding was the teacher utterance. Each utterance was examined to determine if an SRL code could apply to it. Therefore, during each minute of instruction time (and ICAP engagement mode), there could be none, one, or more teacher utterances assigned an SRL direct promotion type code. Table 10 shows the number of teacher utterances to which an SRL direct promotion type code was assigned for each of the four ICAP engagement modes. Most of the utterances assigned an explicit (87%), implicit (70%) strategy and/or promotion of knowledge/beliefs (86%) code, were associated with Passive, Active and Active-Collaborative ICAP engagement modes. On the other hand, metacognitive reflection and metacognitive support were more frequently associated with Active, Constructive and Interactive engagement modes.

Overall, more teacher utterances were given an SRL direct promotion code when the tasks were Passive and Active (341 and 428 utterances) than Constructive and Interactive (208 and 155 utterances). This is not surprising given that there were many more Passive and Active than Constructive and Interactive tasks and minutes of instruction in the sample (see Table 3 and 4). To obtain a better estimate of the frequency of SRL direct promotion during each ICAP engagement mode, we calculated the ratio of the total number of utterances with SRL direct promotion type codes to a) the total number of minutes of instruction time, and b) the total number of tasks assigned to each ICAP engagement code (Table 11). The results indicated that the teachers were more likely to engage in some form of direct SRL promotion during Active, Constructive, and Interactive minutes/tasks than Passive ones.

Table 10 Frequency of teacher utterances associated with the four ICAP engagement modes, to which an SRL promotion type code was assigned

Teacher utterances with SRL promotion type codes	Passive mode	Active & collaborative mode	Constructive mode	Interactive mode	Total
Explicit strategy	19 (50%)	14 (37%)	2 (5%)	3 (8%)	38
Implicit strategy	153 (43%)	96 (27%)	62 (18%)	41 (12%)	352
Knowledge beliefs	42 (62%)	16 (24%)	9 (13%)	1 (2%)	68
Metacognitive reflection	37 (11%)	153 (47%)	62 (19%)	72 (22%)	324
Metacognitive support	90 (26%)	149 (43%)	67 (19%)	38 (11%)	344
Total	341	428	208	155	

Teacher differences in SRL promotion

An examination of the data revealed substantial teacher differences in both direct and indirect SRL promotion. In the case of SRL direct promotion, all teachers used some instances of metacognitive support, metacognitive reflection, and implicit strategy but not of explicit strategy and knowledge beliefs about learning (Fig. 1). Ten teachers did not use explicit strategy promotion at all and six made no reference to knowledge and beliefs about learning.

The teachers also differed in their mention of the benefit of use of a taught strategy or knowledge about learning related to SRL. Such instances could range from 1 to 2 to as many as 40 to 45 instances in one lesson, as shown in Fig. 2.

There were also differences among teachers in the profiles of their use of the different ICAP modes of engagement (Fig. 3). Six of the teachers did not use any Constructive or Interactive tasks and about half designed almost exclusively Passive and Active lesson tasks. In contrast, the remaining teachers spent greater percentages of their lesson in occupying their students with Constructive and Interactive tasks.

To investigate relations between direct and indirect promotion of SRL while considering teacher differences, we separated the teachers into low and high SRL, ICAP and SSD groups. The high SRL group included 12 teachers who used all the different types of SRL promotion in their lesson and had a high frequency of instances of benefit of use. The low SRL group included the remaining teachers who used almost exclusively (more than 80% instances) metacognitive reflection and support and no or very little strategy and knowledge/beliefs promotion types and instances of benefit of use mention. In the case of ICAP, the high ICAP group included 12 teachers in whose lessons the students were engaged in more than 10 min of constructive and interactive activities, while the low ICAP group included the remaining teachers whose lessons had either only Passive and/or Active tasks, or (in two cases) where the students spent fewer than 10 min in overall constructive and interactive activities. In a similar fashion, we assigned the teachers to a low SSD group based on the extent of their promotion of student self-determination. The low SSD group included 11 teachers with fewer than 3 instances of self-determination and those with no major choices. The high SSD group included 12 teachers with 3 or more instances of self-determination or at least one major self-determination choice.

We examined relations between the low and high groups using Independent Sample t-tests. The results showed no significant difference in ICAP and SSD scores between low and high SRL direct promotion groups, and no significant difference in SRL direct promotion and SSD between low and high ICAP groups. We found a marginal significance (at 10% level) in ICAP scores between low and high SSD groups. The lessons with higher ICAP scores had higher frequency of SSD (Table 12).

Summary of results

1) Across the observed lessons only about one-third of the lesson time required students to engage in Constructive and Interactive ways with lesson content. There were few opportunities for students to determine aspects of their learning.
2) The direct support of SRL through explicit strategy instruction and promotion of knowledge and beliefs about learning was rare. However, the teachers did provide students

Table 11 Ratio of total number of utterances with SRL promotion type codes to a) total minutes of instruction and b) total lesson tasks identified in each ICAP engagement mode

ICAP engagement modes	Total number of utterances with SRL codes to total minutes of instruction in each engagement mode	Total number of utterances with SRL codes to total number of tasks in each engagement mode
Passive	341/295 (1.15)	341/39 (8.74)
Active/Collaborative	428/324 (1.32)	428/40 (10.7)
Constructive	208/167 (1.24)	208/16 (13.0)
Interactive	155/112 (1.38)	155/12 (12.91)

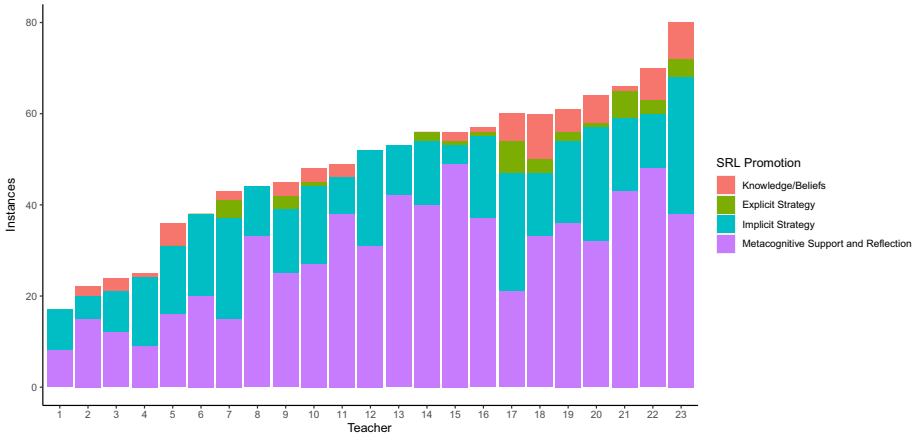

Fig. 1 Observed instances of SRL direct promotion in the participating teachers

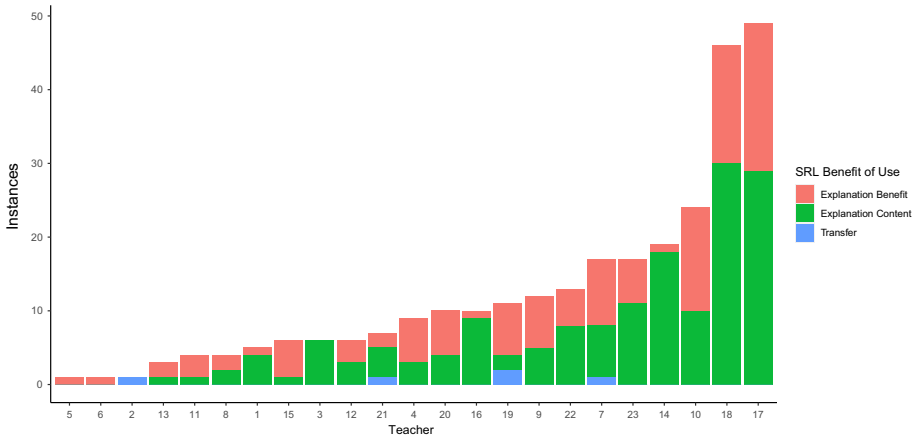

Fig. 2 Observed instances of Benefit of use in the participating teachers

with many instances of implicit strategy instruction, metacognitive reflection and metacognitive support.

3) There were no statistically significant correlations between direct and indirect SRL promotion.
4) Explicit and implicit strategy promotion and the promotion of knowledge/beliefs took place when the students were engaged mostly in Passive and Active tasks, while metacognitive support and reflection took place predominately during Active, Constructive and Interactive tasks. Overall, the teachers were more likely to engage is some form of SRL direct promotion, albeit mostly the form of metacognitive reflection and support, when the students were engaged in Constructive and Interactive tasks.
5) There were important teacher differences in both the direct and indirect promotion of SRL, but the teachers who were more likely to design Constructive and Interactive lesson tasks did not necessarily promote SRL directly and vice versa.

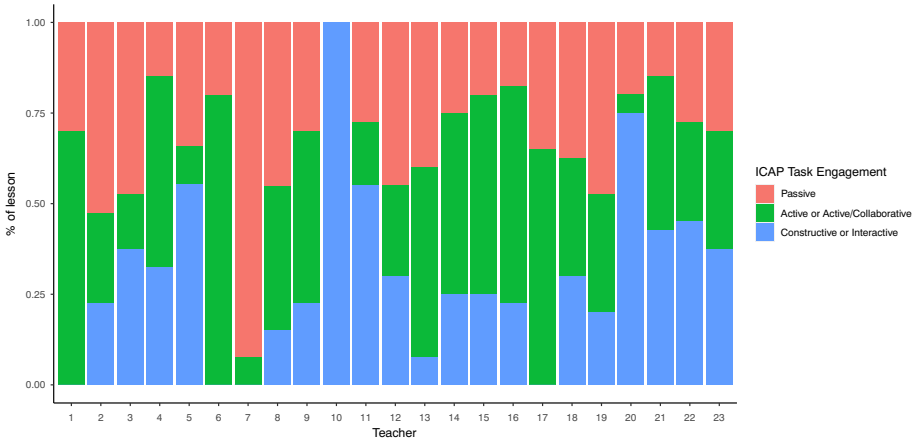

Fig. 3 Instances of indirect promotion of SRL (ICAP engagement codes) in the participating teachers

Discussion

The research developed an SRL Teacher Promotion Framework (SRL-TPF) that introduced certain theoretical and methodological innovations in the investigation of teacher practices that promote SRL. First, the ICAP theory and the ICAP-CG were used as the basis for examining the indirect promotion of SRL in the classroom. The ICAP-CG is a low inference observation protocol that provides measurable and reliable information about the nature of student cognitive engagement stimulated by teacher talk and action. Second, the SRL-TPF expanded the criteria for the investigation of the direct promotion of SRL proposed in previous research by including new SRL promotion types, such as the enhancement of students' knowledge and beliefs about learning and the promotion of metacognitive reflection and support. Finally, the new framework allowed us for the first time to study the relationships between direct and indirect promotion of SRL.

Indirect promotion of SRL

Researchers agree that a learning environment that supports the development of student SRL is an environment that engages students in complex, open ended, constructive tasks that provide opportunities for collaboration and for freedom to decide on aspects of their learning (e.g., Dignath & Veenman, 2021; Perry, 1998; Perry & VandeKamp, 2000). The use of the ICAP-CG allowed us for the first time to have an objective measure of teacher promotion of student cognitive engagement in the observed classrooms, as a function of teacher designed lesson tasks. Only 24% of the total number of the observed lesson tasks met the criteria for Constructive and Interactive student engagement, while in half of the participating classrooms teacher instruction promoted no or very little engagement in such tasks. The teachers provided little freedom to students to determine aspects of their learning, with student self-determination being greater in the classrooms that engaged the students constructively and interactively.

The above findings agree with previous research using the ICAP-CG (Authors, 2023) and with the results of previous SRL observation studies with secondary school teachers (e.g., Dignath & Büttner, 2018; Dignath-van Ewijk et al., 2013), which indicate

Table 12 Independent sample t-test based on the low and high group

(1) SSD and SRL across the two groups of ICAP

	ICAP	N	Mean	Std. Deviation	Std. Error Mean			
SSD	Low ICAP	10	2.10	1.969	0.623			
	High ICAP	13	3.38	2.663	0.738			
SRL	Low ICAP	10	44.00	15.078	4.768			
	High ICAP	13	52.77	16.659	4.620			
		Levene's Test		T-test for Equality of Means				
		F	sig	t	df	Significance	Mean Diff.	SE Diff
SSD	Equal variances assumed	0.433	0.518	−1.278	21	0.215	−1.285	1.005
SRL	Equal variances assumed	0.134	0.718	−1.303	21	0.207	−8.769	0.966

Note: No significant difference in SSD and SRL between low ICAP and high ICAP

(2) ICAP and SRL across the two groups of SSD

	Determination	N	Mean	Std. Deviation	Std. Error Mean			
Constructive Interactive (CI)	Low Determination	10	8.20	5.884	1.861			
	High Determination	12	15.50	11.627	3.356			
SRL	Low Determination	11	45.18	17.713	5.341			
	High Determination	12	52.42	14.687	4.240			
		Levene's Test		T-test for Equality of Means				
		F	sig	t	df	Significance	Mean Diff.	SE Diff
CI	Equal variances assumed	3.048	0.096	−1.798	20	0.087	−7.300	4.060
SRL	Equal variances assumed	1.004	0.328	−1.070	21	0.297	−7.235	6.762

Note: There is a significant difference (at 10% level but not at 5% level) in Constructive Interactive score between low and high determination groups

(3) ICAP and SSD across the two groups of SRL

	SRL Promotion	N	Mean	Std. Deviation	Std. Error Mean
Constructive Interactive (CI)	Low Promotion	10	9.00	8.406	2.658
	High Promotion	12	14.83	10.735	3.099
SSD	Low Promotion	10	3.10	3.143	0.994
	High Promotion	13	2.62	1.805	0.500

Table 12 (continued)

		Levene's Test		T-test for Equality of Means				
		F	sig	t	df	Significance	Mean Diff.	SE Diff
CI	Equal variances assumed	0.062	0.805	−1.396	20	0.178	−5.833	4.177
SSD	Equal variances assumed	1.666	0.211	0.467	21	0.646	0.485	1.038

Note: No significant difference in Constructive Interactive and SSD scores between low and high SRL promotion groups

little overall support for the indirect promotion of SRL. For example, Dignath and Büttner (2018) found that only 3 of the 16 secondary school teachers in their sample obtained high scores on their rating scale for the indirect promotion of SRL.

While the research findings show the absence of support for the indirect promotion of SRL in the case of secondary school classrooms, this might not be the case with primary schools. In the same study reported earlier by Dignath and Büttner (2018), the authors reported that the primary school teachers were better at designing a constructivist learning environment than the secondary school teachers. Perry et al. (2008) also argued that some of the primary school teachers they studied gave students opportunities to engage in complex tasks and promoted student-centered and collaborative learning that enhances SRL (see also Cartier et al., 2010), a finding which agrees with the conclusions derived from a review of the literature on teachers' role in the promotion of SRL by Moos and Ringdal (2012).

Dignath and Büttner (2018) argued that primary school teachers usually receive more training oriented towards child development and pedagogical strategies than secondary school teachers and this might explain the above-mentioned differences regarding the indirect promotion of SRL. Although this may also be true with Australian teachers, it is important to mention that many of the secondary school teachers in our sample designed open-ended learning environments which however promoted active and not constructive or interactive student engagement. There is also some evidence to indicate that some of the primary school teachers who received high scores for the indirect promotion of SRL in previous studies did so only in some of the relevant categories of the ATES guide (such as cooperative learning and encouragement of student autonomy) and not in others, such as complex problem solving and the fostering of transfer of learning (Dignath-van Ewijk, 2011; Kistner et al., 2010). More research is needed to better understand the nature of the tasks primary and secondary school teachers design using the stricter assessment of cognitive engagement used in the ICAP theory. Nevertheless, the finding of the low occurrence of Constructive and Interactive lesson tasks in the present study indicates that many of the teachers did not understand or did not appreciate the importance of designing constructive and interactive lesson tasks for student learning and the development of SRL. This is not a surprising finding, given that the education literature focuses on the importance of students' being generally active without adequately addressing the distinction between Active, Constructive, and Interactive cognitive engagement. This is unfortunate, considering the substantial learning gains that are associated with involvement in Constructive and Interactive tasks (Chi & Wylie, 2014; Menekse et al., 2013).

Direct promotion of SRL

The results confirmed the findings of previous research showing that explicit strategy instruction was rare (Dignath & Büttner, 2018; Dignath-van Ewijk et al., 2013; Hamman et al., 2000; Kistner et al., 2010; Moely et al., 1992; Veenman et al., 2009). They went much further than previous results, however, in providing detail about when and how the teachers used explicit strategy instruction, as well as the other SRL promotion types investigated. For example, the few cases of explicit strategy instruction observed did not involve domain general learning strategies, but mostly domain specific, cognitive, strategies. In most cases, this type of domain specific explicit strategy instruction occurred during mathematics lessons where the focus is often placed on the teaching of specific problem-solving procedures. Considering that many of the previous observation

studies also involved math classrooms, we can speculate that domain general explicit strategy instruction might be even rarer than originally thought. It was observed only in 7 out of a total of 1,126 (0.6%) instances of direct SRL promotion recorded in this study.

A type of direct SRL promotion studied for the first time is the promotion of students' knowledge and beliefs about learning. When it happened, this powerful type of SRL promotion often involved not only cognitive but also metacognitive and motivational capabilities, was domain general, and was accompanied with explanations of the benefit of use of such knowledge. In other words, it had all the characteristics research has revealed to be important in interventions likely to increase students' SRL knowledge and motivation (Dignath & Veenman, 2021; Hattie et al., 1996; McCombs & Marzano, 1990; Schraw, 1998). Unfortunately, this type of SRL direct promotion was overall rather rare (68 instances out of 1,126 or 6%).

Most of the instances of direct SRL promotion were of implicit strategy instruction, metacognitive reflection, and metacognitive support. Although implicit strategy promotion might be of value for the development of student SRL capability it places the responsibility for such development almost totally on the students, who need to notice that a possibly useful strategy is being used by the teacher. A slight change in the actions of the teacher, such as in naming and modelling the strategy, would have a better payoff for the students in their development of knowledge about, and use of strategies for SRL.

An important aspect of the SRL-TPF was the inclusion of metacognitive reflection, and metacognitive support. When taken together, these two types of SRL promotion were the most frequently observed overall (at 59%). Although similar in that they both targeted metacognition, there were important differences between them. Metacognitive reflection was used primarily to make students aware of possible failures in their monitoring or evaluation of information and used prompting as the manner of promotion (e.g., Does it make sense?). Metacognitive support on the other hand was often used to provide students with motivational support (e.g., You are right. This makes good sense), or to remind them of strategies instructed in the past that could be used in the present context. Both occurred when students were involved in monitoring information during Constructive and Interactive tasks, a finding that agrees with the results of Spruce and Bol (2015) that teachers are more likely to actively promote SRL during the monitoring phases of learning.

Unfortunately, given the importance of explaining to students the benefit of use of their SRL "toolkit", instances of metacognitive reflection, and support, as well as implicit strategy instruction were by far the least likely to mention benefit. When combined, only 7% of metacognitive reflection/support instances mentioned benefit. By contrast, those forms of promotion with the greatest percentage of benefit of use—35% of knowledge/beliefs examples and 34% of explicit strategy examples—were by far the least frequent types of SRL promotion observed.

Previous research has highlighted the importance of increasing student metacognition about strategy use (e.g., Depaepe et al., 2010; Dignath & Veenman, 2021; Hattie & Yates, 2013; Spruce & Bol, 2015; Zepeda et al., 2019) and noted the absence of adequate metacognitive strategy instruction in teachers' instructional practices (e.g., Dignath & Büttner, 2018; Hamman et al., 2000; Kistner et al., 2010; Moely et al., 1992; Veenman et al., 2009). The present results confirm the absence of explicit teaching of metacognitive strategies. However, the frequent use of metacognitive reflection and support reveals an awareness on the part of the teachers of the difficulties students may have in monitoring and evaluating their learning and of the need to provide them with some support. Future interventions could build on this finding to help teachers improve their explicit support of student

metacognition, with more explicit types of SRL promotion that also include mention of their benefit of use.

Patterns of interactions between direct and indirect SRL promotion

Explicit strategy instruction, the promotion of knowledge/beliefs and to some extent implicit strategy instruction occurred primarily during whole class instruction when the students were engaged in the Passive engagement mode and therefore when learning gains were expected to be the lowest. When the students were engaged in lesson tasks with higher expected learning gains, i.e., in the Active, Constructive, and Interactive engagement modes, the teachers used the less explicit types of SRL direct promotion, namely, metacognitive reflection and support.

This finding suggests that the overall impact of explicit and implicit strategy promotion might be diminished by its absence in the context of Constructive and Interactive lesson tasks that would enable the students to experience how the strategy is being used making it more likely that they will use it in the future. Teaching explicit and direct SRL strategies during constructive and interactive tasks is the best way to help students become aware of how they can best plan, monitor and evaluate their learning actions in the process of becoming self-regulated.

Lack of correlations between direct and indirect SRL promotion

No significant correlations were obtained between the direct and indirect promotion of SRL, other than the relationship between ICAP engagement modes and student self-determination, which showed that teachers were more likely to provide some freedom of choice to their students when they were engaged in Active, Constructive, and particularly in Interactive tasks. These results agree with the findings of Pauli et al. (2007) that teachers SRL promotion was independent from teacher practices focusing on higher-order thinking and problem solving in the Swiss eight-grade mathematics classrooms they investigated, and that teachers' constructivist beliefs correlated only with the opportunities for independent learning provided by teachers. They also agree with findings showing that teachers who may be good at giving students freedom of choice about their learning do not necessarily teach them how to manage their autonomy (Bolhuis & Voeten, 2001), and that even teachers who are knowledgeable about SRL and who take actions to support SRL indirectly do not explain to their students the rationale behind their actions so that they could learn how to self-regulate (Spruce & Bol, 2015).

As noted earlier the findings in this research point to the potential value to be gained by placing emphasis on bringing together forms of indirect and direct SRL promotion in lesson design. For example, the extent to which the upper levels of cognitive engagement mode of lesson tasks could leverage explicit, or implicit, strategy instruction could be an important area of future research.

Teacher differences

In the case of the indirect promotion of SRL, only about half of the teachers were found to be knowledgeable in designing Constructive and Interactive tasks (High ICAP group). The remaining teachers designed almost exclusively Passive and Active lesson tasks that did not

provide many opportunities for the indirect promotion of SRL (Low ICAP group). In the case of the direct promotion of SRL, half of the teachers used only implicit strategy, metacognitive reflection and metacognitive support types of SRL promotion and demonstrated no or very little explicit strategy instruction and promotion of students' knowledge and beliefs about learning (Low SRL direct promotion group), while the remaining teachers demonstrated use of all the types of SRL direct promotion investigated (High SRL group).

Independent t-tests showed no significant relations between the teachers who were assigned to the High/Low ICAP and SSD groups and those assigned to the High/Low SRL direct promotion groups, confirming the results of the Pearson correlation discussed earlier. An examination of the data revealed a possible association between teacher differences in SRL promotion and the More or Less Advantaged schools in our sample. As shown in Table 13, 58% of the teachers assigned to the High ICAP group taught in the More Advantaged schools with only 25% in the Less Advantaged schools. In contrast, only 37% of the teachers assigned to the High SRL direct promotion group taught in the More Advantaged schools compared to 100% teachers who taught to the Less Advantaged schools.

This finding suggests that in the case of some of the teachers the presence or absence of SRL promotion was not based on lack of knowledge, but on their beliefs about the kind of instruction best suited for their students. Prior research has shown that some teachers may believe that the promotion of SRL might be more important in young and less talented students (Waeytens et al., 2002) compared to older and more able students, although there are also findings indicating that in some teachers the opposite may be the case (Peeters et al., 2016). Unfortunately, it is not possible to draw any firm conclusions from the present research because of the small number of schools, and especially schools in the Less Advantaged category in the sample. More research is needed to investigate how teachers' beliefs regarding student ability may influence their direct and indirect SRL promotion practices.

Implications for educational policy and practice

The development of students' abilities to self-regulate their learning is an important aspect of education for the twenty-first century – an education that prepares students to deal with the challenges of a complex and constantly changing world (Bjork et al., 2013; OECD, 2020). It is important that teachers understand how to promote self-regulated learning in their classrooms. The results of the present research indicate that many teachers do not know or do not value the importance of SRL promotion. About half of the teachers in our sample did not engage their students in Constructive and Interactive tasks that require students to practice their SRL skills. The teachers rarely taught learning strategies explicitly or talked to their students about how learning happens and how it can be improved. These findings highlight the need for education and professional development about SRL for pre-service and in-service teachers. Teaching of the different components of SRL and providing clear examples of how to promote it should become a priority in professional development and university courses for teachers.

An important finding of the study was the high occurrence of metacognitive support and metacognitive reflection statements on the part of the teachers, suggesting an awareness

Table 13 Percent High SRL and High ICAP promotion in the More and Less Advantaged Schools

Teacher group	More advantaged school	Less advantaged school
High ICAP	11/19 (58%)	1/ 4 (25%)
High SRL	7/19 (37%)	4/4 (100%)

on their part of the difficulties that students may experience in monitoring and evaluating information. This finding indicates that teachers may be receptive to professional learning that will show them how to build on and enrich their statements of metacognitive reflection and metacognitive support by providing more explicit information about strategies or knowledge that might be relevant to students during the monitoring of their learning while engaged in Constructive tasks. Considering the findings of meta-analytic studies showing the importance of integrating strategy instruction with learning content, the findings of the present research that teachers tend to see the design of Constructive tasks as independent from the direct promotion of SRL are of concerning importance. Future interventions should combine professional learning about how to design Constructive and Interactive lesson tasks with instruction about how to support students to successfully complete such tasks through the provision of explicit strategy instruction. Consideration of this point suggests that designers of teacher education programs could provide work to reduce the artificial divide between content knowledge and knowledge of how to process that content during learning.

Limitations

The small number of teachers that participated in the study is one of the research's limitations. More research is needed to use the SRL-TPF with a larger and more diverse sample to obtain a better understanding of how teachers promote SRL in the classroom. It is particularly important to further examine and understand teacher differences in the direct and indirect promotion of SRL as well as the possible interactions between SRL promotion and type of school (More or Less Advantaged) that the research has identified using questionnaires and interviews.

It was not one of the purposes of the present research to investigate relationships between teachers' SRL practices and their beliefs about learning and about SRL or perceptions of their self-efficacy in teaching. Further research is needed in this direction, both quantitative and qualitative based on extensive teacher interviews. There are, of course, other factors that might underly the pattern of findings here, including differences in teachers' experience, teaching styles, education, and knowledge as well as contextual and situational factors such as the school environment. Further research is needed to answer these questions.

The present research focused on the analysis of teachers' practices rather than on student learning. Research in the cognitive and educational sciences has shown the important role that 'others' – and particularly teachers – can play in the development and learning of students (Bruer, 1993; Vygotsky, 1978). By how they teach, namely through appropriate verbal instruction and modeling, teachers can scaffold the required knowledge (and hopefully also the will) for self-regulated learning behaviors in their students. The present research focused on the examination of such teacher practices. Future research is needed to investigate whether the recommended teacher practices do indeed develop self-regulated learning in students.

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Data Availability Data can be made available upon request

Declarations

Ethical approval Approval for the research was granted by the Human Research Ethics Committees of Flinders University and The University of Melbourne and from the Department for Education of South Australia.

Informed consent All participants were informed and signed a letter of consent.

Competing interests The authors report there are no competing interests to declare.

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