Teachers' Professional Competences in Self-Regulated Learning: An Approach to Integrate Teachers' Competences as Self-Regulated Learners and as Agents of Self-Regulated Learning in a Holistic Manner

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Competences in self-regulated learning (SRL) are important prerequisites for success in school and beyond. Teachers play a crucial role in students' development of SRL. When focusing on teachers' professional competences in SRL, their experiences as self-regulated learners and their competences as agents of SRL are important. At present, an integrative and holistic framework that combines these two important aspects of SRL with regard to teachers' professional competences in SRL is absent. First, this paper introduces a theoretical framework for teachers' professional competences and instructional practices in SRL that integrates teachers' competences as self-regulated learners with their competences as agents of SRL. This integrative approach allows for differentiated analyses of particular aspects of competences and creates the possibility to deeply understand the reasons why teachers do or do not promote SRL in classrooms. In the second part of this paper, the interplay of teachers' professional competences as self-regulated learners and agents of SRL, with their intention to implement SRL in classes and their self-reported SRL teaching practices, is examined using data provided by 106 in-service teachers from primary and secondary schools. We assessed teachers' professional knowledge about SRL (i.e., content knowledge about SRL [CK-SRL] and pedagogical content knowledge about SRL [PCK-SRL]) with two different knowledge tests. Teachers' beliefs (i.e., implicit theories about SRL and beliefs about promoting SRL) and their motivations (i.e., self-concept about one's SRL and self-efficacy to promote SRL) were assessed with self-report measures. We found that teachers had small to average amounts of CK-SRL and PCK-SRL. Teachers reported positive beliefs about and motivation toward SRL. Most importantly, the results highlight the significance of differentiating between teachers' competences as self-regulated learners and as agents of SRL when examining teachers' implementation of

SRL. The findings provide support for particular aspects of the integrative approach outlined in the theoretical framework and suggest that this approach can be the basis for further research exploring the interplay of teachers' competences as self-regulated learners and as agents of SRL in more detail, particularly with regard to how aspects of teachers' competences in SRL impact their SRL instruction in classes and students' SRL development.

INTRODUCTION

The importance of competences in self-regulated learning (SRL) for academic achievement, thriving in life, and lifelong learning have been highlighted by researchers (Sitzmann and Ely, 2011; Donker et al., 2014; Dent and Koenka, 2016). This importance is further underscored by the fact that competences in SRL have been included in the latest curricula and educational standards as a key aspect of cross-curricular competences (OECD, 2019). Self-regulated learners are active agents in their learning process, which involves their attempt to monitor and regulate their cognition, motivation, and behavior with respect to their learning goals and contextual conditions (Pintrich, 2000). According to this definition, SRL does not comprise a single skill but requires a wide range of cognitive, metacognitive, motivational, emotional, and behavioral competences (including knowledge, attitudes, skills, and values) to face complex challenges (Greene, 2018). Moreover, this definition emphasizes that SRL competences are developed, experienced, and used under social and environmental influences (Panadero and Järvelä, 2015). Successful SRL processes require learners to be capable and willing to apply and combine the relevant competences so that they have control over their own learning. Thus, successful learners are characterized by high amounts of metacognitive knowledge and elaborate strategy repertoires, positive motivational orientations, and beliefs that support in-depth and persistent SRL (Schneider and Preckel, 2017). Thus, SRL is complex and demanding, and learners of various ages have reported difficulties in developing SRL (Peverly et al., 2003; Karlen, 2016a).

For SRL to develop, it must be actively challenged and promoted in the classroom (Perry and VandeKamp, 2000; Pressley and Harris, 2006). There is a consensus among researchers that competences in SRL can be improved and supported by teachers (Donker et al., 2014; de Boer et al., 2018). However, the time that teachers spend addressing SRL is very limited in everyday classes. In particular, researchers have reported low explicit strategy instruction, hardly any promotion of metacognitive knowledge, and low levels of diagnosing students' SRL (Vandevelde et al., 2012; Klug et al., 2013; Kistner et al., 2015; Karlen, 2016b; Dignath and Büttner, 2018). Given that teachers play a key role in supporting students' SRL development, there is a need to better understand which particular competences of teachers support SRL instruction in classes and, following from this, students' development of SRL.

When focusing on a teacher's professional competences in SRL, two primary areas become relevant: teachers' SRL competences and experiences (i.e., teachers as self-regulated learners) and their competences in diagnosing, modeling, and supporting SRL in classes (i.e., teachers as agents of SRL; (Paris and Winograd, 2003; Gordon et al., 2007; Perry et al., 2008; Kunter et al., 2013; Peeters et al., 2014; Bembenutty et al., 2015). Until recently, most theoretical concepts and empirical studies have focused on only one of these two areas of competence in SRL, highlighting the need for an integrative and holistic approach that combines both theoretical approaches of SRL regarding a teacher's professional competences. Such an approach would allow for differentiated analyses of each competence aspect and create an opportunity to deeply understand why, how, and under what conditions teachers promote SRL in classes.

Our paper aims in Part I to introduce a conceptualization of teachers' professional competences in SRL that integrates both areas of these competences: teachers as learners and as agents. To achieve this, we summarize theoretical and empirical findings on teachers' SRL and develop a theoretical framework for investigating the interplay of teachers' professional competences in SRL with their SRL teaching practices and the development of students' SRL. In Part II, we present data that examines the interplay of teachers' knowledge, beliefs, and motivation regarding SRL as it relates to both areas of competence. For this purpose, we present the results of our empirical study that examines the relationships between some aspects of teachers' professional competences in SRL and their SRL self-reported teaching practices. However, we do not aim to confirm the model as complete but to take initial steps in the examination of the interplay of particular aspects of the model.

PART I – AN INTEGRATIVE FRAMEWORK OF TEACHERS' PROFESSIONAL COMPETENCES IN SELF-REGULATED LEARNING

Conceptual frameworks of teachers' professional competences cover several aspects of competence that are linked to teachers' classroom practices, which in turn affect students' learning outcomes (e.g., Baier et al., 2019; Fauth et al., 2019). This relates to general frameworks of teachers' professional competences that emphasize the importance of teachers' knowledge, beliefs, and

motivation for students' development of competences and their achievements (Shulman, 1987; Woolfolk Hoy et al., 2006; Kunter et al., 2013; Blömeke et al., 2015). Moreover, subject-related studies have pointed to the relevance of subject specificity within a teachers' professional development, concerning subject-related knowledge, beliefs and motivations, which greatly modulates the student development of subject-specific competences (Fauth et al., 2019; Backfisch et al., 2020). Against this background, competence models were adapted for different school-subjects (e.g., Kunter et al., 2013). This relationship between teachers' competences and classroom practices is also reported for SRL. Differences between teachers in the promotion of SRL can be traced back to differences in their professional knowledge, beliefs, and motivation as well as differences in their ability to self-regulate their learning (Wilson and Bai, 2010; Moos and Ringdal, 2012; Spruce and Bol, 2015; Dignath and Büttner, 2018). However, the adaptation of general frameworks of teachers' professional competences to teachers' professional competences in SRL has yet not been addressed.

An integrative and holistic framework of teachers' professional competences in SRL should consider both areas of competence: Teachers own SRL competences and experience as self-regulated learners (i.e., teachers as self-regulated learners) and their competences in instructing, diagnosing, and supporting SRL in the classroom (i.e., teachers as agents of SRL). To build on the existing discussions on professional competences, a new integrative framework should include existing frameworks on SRL and teachers' professional competences. Thus, we adapted models of professional competence of teachers, which postulate knowledge, beliefs, and motivation to be important for teachers' classroom practices (Shulman, 1987; Woolfolk Hoy et al., 2006; Kunter et al., 2013) and added the competences of teachers as self-regulated learners (Gordon et al., 2007). This is important, as unlike teaching a specific school subject, which usually corresponds to individual teachers' interests (Richardson et al., 2014), teachers' interests for teaching SRL may vary widely. Compared to established school subjects (e.g., math, sciences, languages), SRL is not defined as a single subject. It is unclear if a teacher's interests and experiences would encourage them to deepen SRL in their teacher training. In addition, SRL is not systematically covered in teacher education, creating a wide range of experiences with SRL. In other words, teachers' professional development in the area of SRL appears dependent on their ability to regulate their learning, their awareness of SRL, and their corresponding experiences in SRL (Gordon et al., 2007; Peeters et al., 2014). Following this line of argument, it becomes important to first intentionally differentiate between the two competence areas, and second, to account for both areas when examining teachers' SRL teaching practices in everyday classes.

Simultaneously examining both areas of competence allows for a systematic disentanglement of particular aspects of teachers' professional competences and instructional behavior as well as outcomes on student level (e.g., students' SRL development and achievement). This provides a basis for understanding the deeper interplay of teachers' professional competences in SRL, their teaching of SRL in classes, and how this impacts students' learning outcomes. All these lines of reasoning are combined in the proposed integrative framework of teachers' professional competences and instructional practices in SRL (see **Figure 1**).

The center is formed by teachers' instructional actions for teaching SRL in the classroom (TSRL). The diagnosis of SRL, as well as direct and indirect promotion and support of SRL, play an important role for students SRL developments. The quality and the quantity of teachers' actions for TSRL are shaped by their professional competences in SRL (TPC-SRL), which comprises teachers' competences as self-regulated learners and as agents of SRL. Both areas of competences cover specific aspects of knowledge, beliefs, and motivation. These are described in more detail in the following sections.

Teachers as Self-Regulated Learners

Teachers' previous experiences are considered to be critical for their instructional practices and the support of students' SRL. Teachers' educational trajectories and experiences in SRL guide their future professional competences as agents of SRL and influence their SRL instruction in classrooms (Paris and Winograd, 2003; Gordon et al., 2007). Through conscious SRL development, teachers may better understand the development of their students' SRL and be better at recognizing and coping with the needs, obstacles, and difficulties that their students may face in becoming more self-regulated learners (Randi, 2004; Peeters et al., 2014). Teachers may better sense the challenges of a strategy's application and make adjustments to ensure the efficacy of instructional and student SRL practices (Paris and Winograd, 2003). For example, when teachers lack a well-developed understanding of how to self-regulate their learning, they are less able to support their students toward becoming successful self-regulated learners (Askell-Williams et al., 2012). A teacher's SRL experiences also influence the extent to which they convey a mastery goal orientation in their classroom and shape their beliefs in the strength of SRL for learning (Gordon et al., 2007). Finally, there is also evidence that teachers are more likely to promote strategies that they master themselves and regard as effective (Glogger-Frey et al., 2018). Thus, it can be assumed that teachers' actions and considerations within the classroom are directed by their competences as self-regulated learners. Although researchers refer to the role of teachers' self-regulation in different ways, only a few studies have explicitly focused on teachers as self-regulated learners (Paris and Winograd, 2003; Peeters et al., 2014).

Teachers' Knowledge as Self-Regulated Learners

Successful self-regulated learners exhibit a high degree of metacognitive knowledge, which is a central component of SRL models (Panadero, 2017). Metacognitive knowledge is linked to the effective selection of strategies and leads to higher achievement (e.g., Maag Merki et al., 2013). The concept of metacognition has been broadly defined as any knowledge and cognitive activity that refers to the monitoring and regulation of cognitive functions (Flavell et al., 2002). This understanding refers to a learners' explicit and implicit knowledge about memory, comprehension, and learning processes (Brown, 1987),

FIGURE 1 | Integrative framework of teachers' professional competences and instructional practices in self-regulated learning.
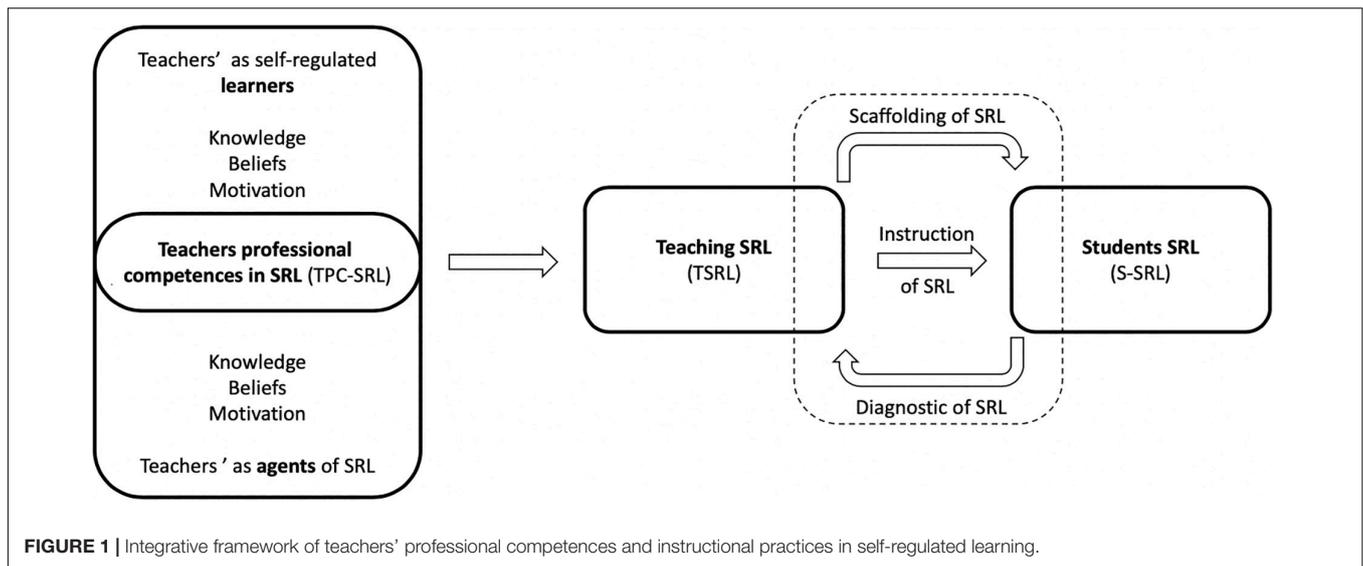
which in turn includes knowledge about the why, how, and when to use certain strategies in different learning contexts. This further extends to one's awareness and knowledge about the strengths and weaknesses of one's memory and information processing (Flavell, 1979). This knowledge helps learners to understand the nature of learning tasks and to choose effective strategies for coping with such tasks (Flavell et al., 2002).

Applied to teacher's knowledge as self-regulated learners it can be stated, that teachers' metacognitive knowledge as well as their awareness about strategies and metacognition itself are crucial. This knowledge and awareness build a basis for the development of metacognitive skills and relates to the promotion and support of metacognition and SRL (Paris and Winograd, 2003; Moos and Ringdal, 2012; Ohst et al., 2015). Wilson and Bai (2010) asserted that teachers must possess a deep understanding of metacognition in order to provide opportunities for metacognitive development in classroom. However, several studies reported that (pre-service) teachers have insufficient and fragmented knowledge about metacognition and SRL (Spruce and Bol, 2015; Kallio et al., 2020). Since accurate and well-organized prior knowledge also determines future accessibility to new (content) knowledge (Prawat, 1989), the support of metacognitive knowledge becomes an important aspect of teacher training, which should establish linkages between existing metacognitive knowledge, misconceptions about SRL strategies, and the acquisition of new content knowledge regarding SRL as well as related instructional strategies.

Teachers' Beliefs as Self-Regulated Learners

Beliefs play an important role in SRL, which contributed to their integration within several models of SRL (Panadero, 2017). The various beliefs of learners and how they impact cognitive and motivational processes have been examined frequently (e.g., Hofer and Pintrich, 1997; Muis, 2007; Haimovitz and

Dweck, 2017). Beliefs build a cognitive framework through which learners interpret their experiences and impacts how they perceive their knowledge and abilities, regulate their motivation and learning behavior, and ascribe meaning to learning (Haimovitz and Dweck, 2017; Compagnoni et al., 2019). Beliefs can function as a standard against which learners set particular tasks and, in turn, influence their SRL. In fact, several studies report finding a relationship between beliefs and SRL. For instance, Hofer and Pintrich (1997) proposed that beliefs may influence the types of strategies learners use, which shapes learners' self-regulated experiences (see also Muis, 2007). In addition, Dweck (2006) suggested that implicit beliefs about abilities can induce particular types of goal orientations for learning and influence how students react to setbacks (for an overview see Dweck and Yeager, 2019). Students holding a growth theory are more likely to assume that human abilities can be acquired, increased, and improved with effort. In contrast, students with a fixed theory believe that human abilities are unchangeable and related solely to given talent. Students with a growth theory mindset master goals more often, persist when facing challenges, rebound better from occasional failures, use adaptive strategies, and have higher metacognitive knowledge in comparison to students with a more fixed theory (Burnette et al., 2013; Haimovitz and Dweck, 2017; Hertel and Karlen, under review).

Such belief systems that are related to one's SRL can impact a teacher's interpretation of SRL theory and the implementation of this theory in their learning and teaching practices (Rattan et al., 2012; Vosniadou et al., 2020). Consequently, teachers' unfavorable beliefs about SRL might not only result in a lack of knowledge about SRL but also influence their value toward the implementation of SRL in classes (Bostwick et al., 2020; Vosniadou et al., 2020). For example, it might be possible that teachers who have a more fixed theory about SRL, perceive SRL as unchangeable and are less likely to believe in the importance of teaching SRL in classes. In line with this assumption, researchers have reported that teachers' implicit theories not only influence

their teaching but also affect students' motivation (Matteucci et al., 2017; Heyder et al., 2020; Vermote et al., 2020).

Teachers' Motivation as Self-Regulated Learners

Motivational variables haven been identified as key factors for academic success and cover aspects such as intrinsic task interest and value, self-efficacy, self-concept, goal orientation, self-attributions, and the regulation of one's motivation (Bandura, 1997; Eccles and Wigfield, 2020; Hattie et al., 2020; Schunk and DiBenedetto, 2020). Learners with higher self-concept, self-efficacy, or task value are often more advanced at difficult tasks, show deeper learning approaches, become more interested and deeply engrossed in their activities, set more challenging goals, and maintain a stronger commitment to those goals compared to students with lower self-efficacy (e.g., Mega et al., 2014; Schneider and Preckel, 2017; Karlen et al., 2019).

Hamman (1998) reported a link between pre-service teachers' valuation and the degree of strategy use and instruction. Further, Paris and Winograd (2003) mentioned that teachers' strategic experiences, as well as their value for SRL, have implications on their capacity to elaborate upon the reasons for and value of using strategies that they introduce in their classes. These results indicate that teachers' might be more inclined to implement strategies into their classes that they value as self-regulated learners. In addition, researchers reported that previous experiences of success or failure might increase or decrease a teacher's self-concept of competence. For example, prior mastery experiences as self-regulated learners might shape future teachers' self-concept of competence in positively promoting SRL (Marsh et al., 2019; Schunk and DiBenedetto, 2020). Thus, teachers' prior mastery experiences in SRL and their perception of their competence as self-regulated learners might be pivotal in the formation of self-concept and self-efficacy for teaching SRL (Tschannen-Moran and Hoy, 2007; Richardson et al., 2014). However, the relationship between teachers' motivation as self-regulated learners and their motivation as agents of SRL has not yet been explicitly examined. Further, it remains an unanswered research question, whether teachers' motivation as self-regulated learners influence their instructional practices with regard to SRL.

Teachers as Agents of Self-Regulated Learning

When referring to general theoretical frameworks on teachers' professional competences (e.g., Kunter et al., 2013; Blömeke et al., 2015), the aspects of knowledge, beliefs, and motivations toward SRL, become particularly relevant when focusing on teachers as agents for SRL.

Teachers Knowledge as Agents of SRL

A teacher's professional knowledge can be divided into different categories (Shulman, 1987). A widely acknowledged distinction is the differentiation of content knowledge (CK) and pedagogical content knowledge (PCK). CK refers to teachers' understanding of the topics to be taught and includes domain-specific knowledge, which is organized in ways that reflect a deep and thoughtful understanding. PCK refers to teachers' knowledge of making specific content accessible to students and constitutes knowledge about students' (mis-)conceptions in a specific domain as well as instructional strategies. Researchers adapted this framework to subject-specific domains (e.g., mathematics, science). PCK is related to teachers' teaching practices as well as to students' domain-specific knowledge development and achievement (e.g., Förtsch et al., 2016; Fauth et al., 2019; Backfisch et al., 2020). Distinguishing between CK and PCK is also important when looking at teachers' professional knowledge in SRL.

CK, in the context of SRL, consists of teachers' specific content knowledge about SRL (CK-SRL), which includes teachers' knowledge of basic concepts such as terminology, theoretical models, and having an understanding of how the SRL process functions. CK-SRL relates to a deeper understanding of SRL theories and concepts, which builds on knowledge and experiences teachers gained as self-regulated learners. It also includes metacognitive knowledge about the specific functions and goals of strategies used in different learning situations. However, CK-SRL goes beyond this knowledge, as it also includes a broader and more general understanding of the concept of SRL as well as a comprehensive theoretical knowledge of SRL. PCK-SRL encompasses teachers' knowledge about different ways of fostering SRL in the classroom and knowing how to support students to acquire competences in SRL. It comprises knowledge about several instructional methods to directly foster SRL (Schraw, 1998; Paris and Paris, 2001) or to indirectly foster SRL by organizing powerful learning environments and opportunities that enable and encourage students to engage in SRL (De Corte et al., 2004; Perry et al., 2008). Finally, it also pertains to knowledge of students' preconceptions, misconceptions, and the difficulties they encounter during the self-regulation of their learning.

Results from intervention studies suggest that teachers' professional knowledge about SRL is malleable and can by fostered (Zohar, 1999; Kramarski and Kohen, 2017). This is important because studies found that teachers have rather low levels of CK-SRL and PCK-SRL. Regrading CK-SRL, studies with pre-service teachers and in-service teachers from different educational levels reported that teachers lack knowledge about the concept of SRL (Waeytens et al., 2002; Askell-Williams et al., 2012; Spruce and Bol, 2015). This lack of knowledge ranges from holding misconceptions or possessing only fragmented knowledge about strategies and metacognition (Zohar, 1999; Ohst et al., 2015; Glogger-Frey et al., 2018). Dignath and Büttner (2018) revealed that primary and secondary school teachers found it difficult to define different strategies and hold more knowledge about cognitive than metacognitive strategies. With regard to PCK-SRL, a similar picture emerged. Several researchers reported low teachers' knowledge about various instructional methods that support SRL (Zohar, 1999; Barr and Askell-Williams, 2020).

Thus far, no studies have examined the relationship between CK-SRL and PCK-SRL. However, the results from studies in other domains have reported positive weak to medium correlations between CK and PCK (e.g., Yang et al., 2020). In line with these

findings, we would expect comparable correlation patterns for CK-SRL and PCK-SRL. The relation between CK-SRL, PCK-SRL, and instructional performance of SRL also remains unclear. Wilson and Bai (2010) found that the correlation between teachers' CK-SRL and their teaching practices with regard to SRL was generally low. Even teachers having high CK-SRL did not consistently demonstrate high levels of SRL supporting teaching strategies. This result is in line with other studies that reported none or low relationships between CK-SRL and (self-reported) promotion of SRL in the classroom (Moely et al., 1992; Spruce and Bol, 2015; Dignath-van Ewijk, 2016). Even though results are not entirely consistent, there is a tendency to find a stronger link between PCK and teachers' instructional quality than between CK and teachers' instructional practice (e.g., Krauss et al., 2020). This points to the relevance of disentangling the different aspects of teachers' professional knowledge about SRL and examine their interplay with instructional practices in everyday school settings.

Teachers Beliefs as Agents of SRL

Teachers' instruction related beliefs are implicit or explicit conceptions about school-, domain-, and learning-related matters that exert considerable influence on their perceptions and judgments about learning as well as their instructional preferences and actions (Pajares, 1992; Ertmer, 2005; Woolfolk Hoy et al., 2006; Fives and Buehl, 2008). Beliefs are not necessarily cohesive as teachers can hold different, even contradictory beliefs at the same time (Lawson et al., 2019; Vosniadou et al., 2020). Consequently, it is important to consider how teachers' belief systems related to their role as agents of SRL influence their SRL practices.

With regard to SRL, different beliefs have been identified as influential and relevant to teachers' actions (Lawson et al., 2019). In this context, we broadly distinguish between: (1) more domain-general (epistemic) beliefs about teaching and learning that might influence SRL (beliefs related to SRL), and (2) more domain-specific beliefs about SRL (Hofer and Pintrich, 1997; Fives and Buehl, 2008; Moos and Ringdal, 2012; Spruce and Bol, 2015). While the relevance of domain-general beliefs related to SRL, such as beliefs about the nature of teaching and learning, have been approved by researches to influence teachers' general teaching practices (Staub and Stern, 2002), only a few studies indicated that such beliefs were related to SRL practices (Dignath-van Ewijk, 2016; Vosniadou et al., 2020). For example, it has been shown that constructivist beliefs are positively related to student-oriented practices such as the support of independent problem solving and even to the promotion of students' SRL (e.g., Kistner et al., 2015). One reason for this might be that students are considered as active processors of information, and teachers might assume that acquiring competences in SRL is rather the result of experience than of direct instruction (e.g., Vermote et al., 2020).

Lawson et al. (2019) comprehensive review of teacher's beliefs assumed that several domain-specific beliefs about SRL are expected to be relevant for teachers' SRL classroom practices. For example, teachers can hold beliefs about individual differences among students' competences for SRL and how suitable SRL is for different groups of students (e.g., Lombaerts et al., 2009). Peeters

et al. (2016) found that teachers might regard the promotion of SRL as being of relevance only to high achieving students and not to other students (see also Zohar et al., 2001). Teachers might also hold different beliefs about the importance of fostering SRL in classes. Teachers holding more positive beliefs toward SRL practices also believed that students could benefit from it and thus supported SRL in their classroom more frequently (Dignath-van Ewijk, 2016; De Smul et al., 2019). Several studies found a positive link between beliefs about SRL and (self-reported) implementation of SRL in classes (e.g., De Smul et al., 2018; Thomas et al., 2020; Vosniadou et al., 2020). Other studies reported that, while teachers expressed mostly positive beliefs about SRL, their support of SRL in classes was overall low (Perry et al., 2008; Spruce and Bol, 2015). Deducing new insights into teachers' professional practice related to SRL would be benefited by combining and investigating domain-general beliefs as well as domain-specific beliefs about SRL. There is also a need for a deeper understanding of the interaction between teachers' beliefs and their knowledge and motivation about SRL, as inconsistent results can be found in literature ranging from none to medium-sized correlations between those variables (Kunter et al., 2013; Dignath-van Ewijk, 2016; Vosniadou et al., 2020).

Teachers Motivation as Agents of SRL

In the field of teachers' professional competences, motivational variables cover aspects such as teachers' self-efficacy, the attributed value to a particular domain, teaching motivation, and enthusiasm, which all influence a teacher's actions in class (Richardson et al., 2014; Zee and Koomen, 2016). Arguing on the basis of the expectancy-value theory (Eccles and Wigfield, 2020), the value individuals allocate to a particular activity (e.g., personal importance of a given task) and the expected success in this activity are key factors that impact their effort and performance. In addition, following Bandura's social cognitive theory of self-efficacy Bandura (1986), teachers' self-efficacy describes their self-perception in their ability to organize and execute actions required to successfully influence student learning and achievement, even in challenging situations (Tschannen-Moran et al., 1998). Teachers' self-efficacy and expectancy-value constructs have been linked to teachers' desirable choices and use of instructional practices and encouragement of students' SRL (Chatzistamatiou et al., 2014; Dignath-van Ewijk, 2016). Higher self-efficacy about teaching is related to greater teaching effort, a higher value of teaching, higher openness to new teaching methods, more effective and innovative teaching behaviors, the tendency of implementing more student-centered classroom practices, and students' academic outcomes (e.g., Tschannen-Moran and Barr, 2004; Klassen and Tze, 2014; Zee and Koomen, 2016; Granziera and Perera, 2019; Backfisch et al., 2020).

Teachers' self-efficacy can vary depending upon the context; thus, teachers might hold different self-perception of their self-efficacy about different instructional tasks (Dellinger et al., 2008). Therefore, it becomes important to adapt the concept of teachers' self-efficacy to the particular situation of implementing SRL in classes. Teachers' self-efficacy for the implementation of SRL can be defined as a teachers' self-perception of their competence to succeed in instructing and promoting SRL in the classroom (De

Smul et al., 2018). There is evidence that teachers' self-efficacy about implementing SRL is related to teachers' (self-reported) instructional practice (Chatzistamatiou et al., 2014; De Smul et al., 2019). Moreover, researchers reported that teachers' self-efficacy for implementing SRL was one of the strongest predictors of teachers' self-reported implementation of SRL in the classroom (Dignath-van Ewijk, 2016; De Smul et al., 2018). Teachers do differ in the value they ascribe to the teaching of different domains, to different teaching concepts, and SRL (Waeytens et al., 2002). Findings from existing research in the domain of SRL indicate that teachers who emphasize the value of SRL also report SRL instruction and support in their classroom more frequently (Vandevelde et al., 2012). Teachers' allocation of value to SRL is related to their self-efficacy regarding SRL, and both predict teachers' SRL implementation in class (De Smul et al., 2019).

To summarize reported results, several teachers' motivational variables have a strong impact on teachers' behavior and support a more favorable instructional environment such as mastery goal structure in classrooms or greater learning support, which all promote students SRL (Zee and Koomen, 2016; Eccles and Wigfield, 2020). However, the results from studies in other fields (e.g., Mathematics, Technology, English) reveal inconsistent relationships between motivational variables and knowledge. Some studies report no correlations between motivational variables, such as utility-value, self-efficacy, or teacher enthusiasm and teachers' CK or PCK (e.g., Fauth et al., 2019; Backfisch et al., 2020). Others noted differences in the correlational patterns between CK and motivational aspects, and between PCK and motivational aspects (e.g., Baier et al., 2019). Some researchers report only small positive correlations between CK and teachers' self-efficacy (e.g., Oppermann et al., 2016). These relations should be examined further regarding teachers' professional competences in SRL.

Teaching Self-Regulated Learning

Self-regulated learning and metacognitive competences (i.e., theory of mind and executive functions) emerge as early as the preschool years and might continue to develop throughout adulthood (Schneider, 2015; Greene, 2018). Learners develop those competences by imitating adults and older learners, as well as through interaction and targeted SRL instruction (Donker et al., 2014; de Boer et al., 2018). Teachers can promote students' SRL in two different ways: directly through the instruction of strategies and indirectly through the construction of a supportive learning environment (Paris and Paris, 2001; Pressley and Harris, 2006; Perry et al., 2008).

With regard to the direct instruction of SRL, teachers can explicitly demonstrate and advise why it is important to use a certain strategy, how to apply it, when or in which situations it is suitable, and what skills are involved in using it. Intervention studies have shown that strategies can be effectively supported by targeted strategy training (Donker et al., 2014). Teachers can also choose a more implicit way of enhancing the use of a strategy without directly informing or advising students about its significance. Thus, direct strategy instruction can be enacted in various ways that differ substantially in their degree of explicitness, such as encouraging students to apply strategic

behavior, asking specific learning-related questions to activate SRL, or explaining and modeling strategies while solving a problem (Moely et al., 1992; Paris and Paris, 2001; Pressley and Harris, 2006). Explicit instruction of SRL by informing students how to apply, monitor, and regulate strategy application has been shown to be highly effective (Greene, 2018).

In terms of indirect instruction, teachers can create powerful learning environment based on constructivist views on learning. Such learning environments are characterized by the following features: (a) Presenting students with complex, authentic, and mindful learning activities that promote both subject-specific knowledge and knowledge about SRL; (b) Offering students autonomy by opening up learning, in terms of content, methodology, collaboration, and organization. In other words, giving students choices about what to work on, when, with whom, and for how long; (c) Facilizing self-regulated and meaningful learning thought orientation toward clear learning goals; (d) Adapting support and feedback to students' individual needs in challenging situations; (e) Implementing assessments forms of (self-)assessment for monitoring and improving learning and actively involving students in evaluation of their learning; (f) Supporting positive beliefs about the self, concerning learning and problem solving (e.g., Schraw, 1998; Perry and VandeKamp, 2000; De Corte et al., 2004; Panadero et al., 2018).

The combination of both direct and indirect approaches to foster SRL is proposed to be highly effective in promoting students' competences in SRL (Paris and Paris, 2001). The promotion of SRL is best combined with the teaching of learning content (school subject) and is not an extracurricular activity. Providing guidance and direct instruction might be most effective for less advanced self-regulated learners, while scaffolding and high levels of autonomy might be more beneficial for advanced self-regulated learners (van de Pol et al., 2010; Chernikova et al., 2020). Consequently, considering differences between students becomes crucial for teachers' SRL instruction and support (Peeters et al., 2016). One central aspect supporting SRL is to gradually shift responsibility from teachers toward students. This implies a transfer from an externally regulated form of learning to a co-regulated form finally moving toward students' self-regulated forms of learning (van de Pol et al., 2010; van Beek et al., 2014). This highlights the important role of continuously diagnosing students SRL competences, which is achieved by coaching students and providing SRL related feedback (Hamman et al., 2000; Klug et al., 2013; Chernikova et al., 2020; Vattøy, 2020). However, several studies reported that teachers rarely integrate SRL in their everyday classroom instruction, provide little direct instruction of strategies, and seldomly emphasize metacognitive aspects of SRL (Kistner et al., 2015; Spruce and Bol, 2015; Karlen, 2016b; Dignath and Büttner, 2018; Zepeda et al., 2019). Moreover, also specific coaching of SRL seldomly occurs (Hamman et al., 2000). Thus, even though teachers perceive SRL as important, their actions for supporting SRL focus on conventional teaching instead of following a broader approach in support of SRL (Huh and Reigeluth, 2018).

To conclude, the promotion of SRL is complex and includes various direct and indirect teaching practices such as diagnosing, modeling, scaffolding, as well as giving feedback and requires

a gradual transfer of the learning process responsibility from teacher to student. The promotion of SRL does not succeed sustainably through the brief practice of one strategy but should be routinely and consciously integrated into everyday teaching. This is also relevant, because the promotion of SRL is associated with positive learning outcomes of students (Hamman et al., 2000; Zepeda et al., 2019).

PART II: FIRST STEPS IN THE EXAMINATION OF THE INTERPLAY OF TEACHERS' COMPETENCES AS SELF-REGULATED LEARNERS AND AS AGENTS OF SRL

The proposed integrative framework (Part I, **Figure 1**) allows for the systematic examination of teachers' competences and their interplay, as well as their relationship to SRL teaching in everyday classes. This is an important step toward gaining a better understanding of teachers' decisions to employ specific instructional practices to support SRL in their classrooms and to understand how students' competences in SRL might develop. In Part II of this paper, we focus on specific aspects of the introduced theoretical framework of teachers' professional competences in SRL. The main focus is on examining the interplay of aspects of teachers' competences as self-regulated learners and as agents of SRL as well as exploring whether both competence areas are relevant to teachers' SRL teaching.

First, we aimed to explore the levels of teachers' professional competences in SRL and the interplay of teachers' knowledge, beliefs, and motivation in both areas of teachers' professional competences in SRL – teachers' SRL competences as learners and teachers' competences as agents of SRL (Research Question 1). Based on previous studies (e.g., Zohar, 1999; Dignath and Büttner, 2018; Glogger-Frey et al., 2018), we expected to find low to moderate levels of knowledge about SRL (CK-SRL, PCK-SRL) amongst teachers (Hypothesis 1). However, we hypothesized that teachers would hold positive beliefs about SRL and show moderate motivation to act as agents of SRL (Hypothesis 2; e.g., Perry et al., 2008; Huh and Reigeluth, 2018). Further, we hypothesized that teachers would show medium amounts of implementation of SRL in class (Hypothesis 3). Even though there is limited evidence on the interplay of teachers' competences as self-regulated learners and aspects of teachers' competences as agents of SRL, we expected to find correlations between these competences (Hypothesis 4).

Second, we aimed to examine the relationship between teachers' professional competences in SRL and their intention to implement SRL in the class as well as their self-reported SRL implementation (Research Question 2). Studies have reported inconsistent relationships between teachers professional competences and (self-reported) implementation of SRL (Kistner et al., 2015; Spruce and Bol, 2015; De Smul et al., 2019) and only limited results are available concerning the importance of their competences as learners of SRL for the implementation of SRL (e.g., Gordon et al., 2007). We expected teachers' competences as

self-regulated learners and their competences as agents of SRL to be positively related to their intentions to implement SRL in class (Hypothesis 5) and to their self-reported implementation of SRL in class (Hypothesis 6).

METHODOLOGY

Participants

Several primary and lower secondary schools in Switzerland were invited to participate in this study. Four different schools located in rural and urban areas volunteered to participate. One hundred and six in-service teachers completed the online questionnaire, which equated to a response rate of 60.1%. Fifty-eight of these teachers worked in primary schools (ISCED level 1) and 48 teachers in lower secondary level schools (ISCED level 2). Teachers were mainly female (73.6%; one person declined to answer this question), and ranged in age from 22 to 64 years (M = 42.8 years, SD = 11.50). The average time of years in service was 15.38 years (SD = 10.51, range: 1–39 years).

MEASURES

The online questionnaire consisted of several scales on teachers' beliefs, motivation, and instructional SRL practices. In addition, two knowledge tests were included. Both knowledge tests (CK-SRL and PCK-SRL) were presented first (after a few questions about the demographic aspects), afterward teachers answered the items related to self-reported beliefs, motivations, and promotion of SRL. **Table 1** presents an overview of all measured constructs including sample items.

Variables on Teachers' Competences as Self-Regulated Learners
Implicit Theories About SRL
We used a validated instrument (Hertel and Karlen, under review) with three items with a five-fold scale to assess teachers' implicit theories about SRL. Higher values represented stronger endorsements of a growth theory about SRL. In other words, higher values equated to stronger belief that SRL is malleable and can be improved with exercise and practice.

Self-Concept About SRL
To measure teachers' self-concept in relation to their SRL, we used a newly developed scale with three items (all items are in the **Appendix**). Participants responded to the items on a six-point scale from 1 (does not apply at all) to six (entirely true).

Variables on Teachers' Competences as Agents of SRL
Content Knowledge About SRL
To assess teachers' content knowledge about SRL (CK-SRL), a new test was developed with complex multiple-choice tasks, each with a short item stem and four answer options (see **Figure 2**). Of these four options, none, several, or all were correct. Altogether,

TABLE 1 | Overview of instruments used.

Construct	Sample item	Number of items	Internal consistency
Teachers' competences as self-regulated learners			
Implicit theories about SRL	Self-regulated learning…(1) cannot be improved by practice/(5) can be improved by practice.	3	0.70
Self-concept about SRL	I am good at self-regulating my learning.	3	0.91
Teachers' competences as agents of SRL			
Content knowledge about SRL (CK-SRL)	see **Figure 2**	22	0.69
Pedagogical content knowledge about SRL (PCK-SRL)	see **Figure 3**	32	0.85
Beliefs about promotion of SRL	Pupils have the capacity to determine what they want to learn.	4	0.73
Teachers' self-efficacy to promote SRL	I can successfully teach students different strategies for self-regulated learning.	3	0.82
Teaching SRL			
II strategic planning	It is important to me personally that my students strategically plan their learning process.	4	0.68
II strategy use	It is important to me personally that my students have learned how to correctly use learning strategies.	4	0.78
II strategy monitoring	It is important to me personally that my students monitor whether they are using a learning strategy correctly while they are learning.	4	0.83
II outcome evaluation	It is important to me personally that my students evaluate whether the learning strategies they chose were helpful.	4	0.82
Overall II-SRL		16	0.85
Self-reported implementation of SRL	In class, students work regularly independently on tasks they have chosen themselves.	4	0.65

II = implementation intention.

the test was designed to assess a conceptual understanding of SRL. Therefore, items covered several aspects of SRL, such as SRL in general (e.g., "What is self-regulated learning?"), learning strategies (e.g., "Which of the following statements on learning strategies are correct?"), and metacognition (e.g., "Which of the following statements best describes the concept of metacognition?). The teachers were asked to rate each answer option (correct or wrong). In the scoring of the test, each individual response option was evaluated. Omitted answers were rated as incorrect.

The test for CK-SRL consisted of 11 tasks with a total of 44 items. The entire test was subjected to an item and scale analysis. Items with negative item-total correlation values were excluded. This resulted in a decrease of 22 items and one entire task. The final CK-SRL test consisted of 10 tasks and 22 items, which led to a minimal acceptable internal consistency value. However, since the scale captures content knowledge of a broad and comprehensive construct, the reliability value was considered satisfactory, and a sum score out of these 22 items was built to represent teachers' CK about SRL. The reported score represents an overall mean test score that ranged from 0 (low CK-SRL) to 22 (high CK-SRL).

Pedagogical Content Knowledge About SRL

The development of the PCK-SRL test builds on rationale scenario-based procedures for measuring metacognitive knowledge of learners (e.g., Karlen, 2017). This test format included textual vignettes of situations (as item stems) that were related to a specific topic, which included several options for action (different approaches/strategies) that varied in their degree of effectiveness or appropriateness for the corresponding scenario (see **Figure 3**). The newly developed test of PCK-SRL included four scenarios describing different situations addressing the implementation of SRL in class (Karlen et al., in prep.). The following situations are as follows. The first situation addressed fostering SRL within a class that has some experience in SRL. The second situation asked about introducing students to a new learning strategy. The third situation was related to fostering metacognitive competences in class. Lastly, the fourth situation introduced learning journals to students. For each scenario, seven different options for action were provided that varied in their degree of effectiveness and appropriateness for the given situation. Each option for action was developed based on existing theoretical and empirical findings on the promotion of SRL. Teachers' had to rate the usefulness of each option of action after considering the scenario-specific initial conditions.

To develop an objective scoring procedure for teachers' responses, scientists in the field of SRL ($N = 15$) were asked to provide their judgments about the usefulness of each option of action. Experts' judgments were used as a reference for the scoring of the test and to estimate the relative relation between all potential pairs of actions (pair comparison). Based on the experts' ratings, we evaluated all theoretically assumed pairs of actions. A pair of actions corresponds to a rated option of action as superior to another option of action (e.g., higher rating for action A than for action B). The paired comparisons served as a qualitative standard and offered a clear benchmark for

Which of the following statements on self-regulated learning are correct? Please tick all correct statements (multiple answers possible). Self-regulated learning implies that ...	
a) schools offer an extracurricular course about how to learn.	
b) students are not being instructed by the teacher.	
c) students do not cooperate with other students.	
d) the result at the end of the learning process is not graded.	

FIGURE 2 | Sample item of the CK-SRL test.

A teacher is teaching a class with little experience in self-regulated learning. She thinks about how she can promote self-regulated learning among her students. She considers different measures. The teacher ...	For each of the following measures, please indicate how useful you consider them. 1 = not useful at all 6 = very helpful					
	1	2	3	4	5	6
e) introduces a metacognitive vocabulary in order to be able to talk and reflect on the learning process with the students.						
f) encourages students to reflect on their own learning behavior.						
g) carries out pure method training (e.g., extracurricular course about how to learn).						
h) gives students a choice of tasks.						
i) carries out more exams so that the students can see their learning progress.						
j) lets students work with competence grids and develops specific tasks for this purpose.						
k) verbalizes thoughts and strategies when solving a task ("thinking aloud").						

FIGURE 3 | Sample scenario of the test to assess teacher PCK-SRL. The displayed scenario has not been included in the final test version.

teachers' answers. A pair comparison was scored as correct if the teacher's individual judgment corresponded with the experts' ratings (1 point). It was rated as incorrect if the judgment on a pair comparison was contrary to the experts' ratings (0 points) (for further information on this procedure see, Karlen, 2017). Overall, the test included 32 pair comparisons, with a high internal consistency value. The reported score represents an overall mean test score that ranged from 0 (no pair comparisons solved correctly, low PCK-SRL) to 1 (all pair comparisons solved correctly, high PCK-SRL).

Beliefs About the Promotion of SRL

An adapted version of the SRL Teacher Belief Scale (SRLTB; Lombaerts et al., 2009) was used to assess teachers' beliefs about SRL on a six-point Likert scale. The original version of the scale consisted of 10 items that focused on various aspects of teachers' support for the introduction of SRL in primary education. Teachers who scored high on this scale can be considered as proponents of SRL. A factor analysis was run to verify the structure of the scale, which revealed several factors (see also Yan, 2018). Due to that reason, we decided to include only a scale

with four items that represented general beliefs about beneficial conditions for the successful promotion of SRL in the classroom in our further analyses (see **Table 1**). The higher a teacher's score on this scale, the more positively they assessed the conditions for the implementation of SRL.

Self-Efficacy to Promote SRL

To measure teachers' self-efficacy regarding the direct fostering of SRL in class, we used a newly developed scale (all items in the **Appendix**). This scale consisted of three items considering teachers' perceived competence toward direct SRL promotion, which were assessed on a six-point Likert scale from 1 (does not apply at all) to six (entirely true). The higher teachers scored on this scale, the more confidently they perceived themselves regarding the direct promotion of SRL.

Teaching SRL
Teachers' Implementation Intentions Related to SRL

Teachers' intentions to implement SRL (II-SRL) were assessed with scales developed by Steinbach and Stoeger (2016). This instrument assesses the importance teachers allocate to the

implementation of SRL, which is expected to represent actual behavior. The original instrument consists of 28 items and seven subscales (four items each), which focus on the cognitive and metacognitive aspects of the SRL process. Answers can be given on a six-point Likert scale from 1 (does not apply at all) to 6 (entirely true). Due to economic reasons, we included only four subscales: strategic planning, strategy use, strategy monitoring, and outcome evaluation. Analogous to Steinbach and Stoeger (2016), we built an overall scale in addition – overall II-SRL – with all 16 items.

Teachers' Self-Reported Implementation of SRL

A scale from Frey et al. (2009) was used to assess teachers' implementation of SRL in a class. The scale addresses the implementation of different teaching methods in the classroom. For this paper, we included only the four items that were related to the teaching of SRL. Answers were provided on a six-point Likert scale from 1 (does not apply at all) to 6 (entirely true).

Plan of Analysis

First, we looked at group differences between elementary school teachers and secondary school teachers for all included variables using SPSS 25. Previous research has revealed differences in SRL practices and experiences between both school levels (Moos and Ringdal, 2012; Dignath and Büttner, 2018). No significant differences were found between both teacher groups for all included variables. Thus, all teachers were treated as one sample. Second, we computed analyses of descriptive statistics and calculated correlations for all variables to answer our first research question. Third, we ran six regression analyses to answer our second research question. We examined the relationship between teachers' professional competences in SRL with their intentions to implement SRL in their class (overall score implementation intention SRL, four specific implementation intentions for particular aspects of SRL) and teachers' self-reported implementation of SRL. For all regression analyses, we controlled for teachers' years of service as teachers might differ from one another in experiences with the implementation of SRL in class. In addition, we ascertained that there was no multicollinearity (Hair et al., 2017). A two-tailed alpha level was set for the analyses.

RESULTS

Research Question 1: Levels of Teachers' Professional Competences in SRL and the Interplay of Teachers' Knowledge, Beliefs, and Motivation as Self-Regulated Learners and as Agents of SRL

The means and standard deviations for knowledge, beliefs, and motivational variables, as well as self-reported intentions to implement SRL are presented in **Table 2**. The descriptive analyses for teachers' knowledge about SRL showed low to moderate amounts of CK-SRL ($M = 16.10$, $SD = 3.12$, range: 8–22) and

PCK-SRL ($M = 0.69$, $SD = 0.19$, range: 0.13–0.97), which is in line with our first hypothesis.

With regard to teachers' beliefs and motivation as self-regulated learners, the analyses resulted in means of $M = 4.35$ ($SD = 0.56$) for implicit theories about SRL, and of $M = 4.76$ ($SD = 0.76$) for teachers' self-concept about SRL. For teachers' beliefs and motivation as agents of SRL, the analyses revealed mean values of $M = 4.30$ ($SD = 0.65$) for teachers' self-efficacy to promote SRL, and of $M = 3.97$ ($SD = 0.68$) for beliefs about the promotion of SRL in classes. These results indicated that teachers' have a positive self-concept about their own competence to self-regulate their learning and think of SRL as being a malleable competence rather than a fixed talent. Further, they rated the (pre-)conditions for the promotion of SRL positively and perceived themselves as potent agents of SRL in class. These findings support our second hypothesis that teachers hold positive beliefs about SRL and show medium levels of motivation for SRL and SRL support in classes.

The values of self-reported SRL implementation revealed that teachers' intentions to implement SRL show a medium-sized variation with lowest reported values for the implementation of strategic planning ($M = 4.05$, $SD = 0.69$) and highest for the intention to implement the teaching of strategy use ($M = 5.13$, $SD = 0.59$). The mean value for the global score for the intention to implement SRL in classes was $M = 4.49$ ($SD = 0.54$), and for the self-reported implementation of SRL in class the mean value was $M = 3.82$ ($SD = 0.78$). In line with hypothesis three, these findings indicated low to medium values for the implementation of SRL in classes.

Examining the correlations of teachers' competences as self-regulated learners, we found no statistically significant correlations between teachers' self-concept about SRL and their implicit theories about SRL. This indicates that both views represented independent aspects of teachers' competences as self-regulated learners. Regarding teachers' professional knowledge about SRL, the analyses revealed that CK-SRL and PCK-SRL were statistically significantly correlated. However, the small correlation coefficient indicated that both address different aspects of teachers' professional knowledge about SRL. For teachers' competences as agents of SRL, a medium-sized correlation was found for teachers' self-efficacy to implement SRL in classes and their beliefs about the promotion of SRL. Teachers with a higher self-efficacy for implementing SRL in classes did rate the preconditions for the promotion of SRL more positively.

Addressing the correlations between aspects of teachers' competences as self-regulated learners and teachers' competences as agents of SRL, small to medium-sized, but statistically significant, correlations were found for teachers' self-concept about SRL and teachers' self-efficacy to promote SRL in classes ($r = 0.41$, $p < 0.001$). Thus, the more confident teachers were about their capabilities to successfully self-regulate their learning, the higher their self-efficacy to promote SRL in classes. Positive correlations were also found for teachers' implicit theories about SRL and CK-SRL ($r = 0.21$, $p < 0.05$), and for teachers' implicit theories about SRL and teachers' beliefs about the promotion of SRL ($r = 0.40$, $p < 0.001$). The teachers committed to the perspective of SRL as being malleable rather than a fixed

TABLE 2 | Means, standard deviations and intercorrelations for all the variables.

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Years of service	15.28	10.51													
2. Self-concept about SRL	4.76	0.76	0.11												
3. Implicit theories about SRL	4.35	0.56	0.09	0.13											
4. CK-SRL	16.10	3.12	−0.27**	−0.01	0.21*										
5. PCK-SRL	0.69	0.19	−0.27**	−0.03	0.02	0.28**									
6. Self-efficacy to promote SRL	4.30	0.65	0.07	0.41**	0.16	0.03	−0.02								
7. Beliefs about promotion of SRL	3.97	0.68	0.02	−0.03	0.40***	0.08	0.05	0.36***							
8. II strategic planning	4.05	0.69	0.13	0.07	0.06	−0.04	0.12	0.24**	0.23*						
9. II strategy use	5.13	0.59	−0.03	0.23*	0.17	0.25**	0.12	0.37***	0.17	0.15					
10. II strategy monitoring	4.09	0.90	0.01	0.33***	0.29**	0.11	0.05	0.36***	0.32***	0.36***	0.59***				
11. II outcome evaluation	4.67	0.78	0.08	0.17	0.32***	0.07	0.21*	0.27**	0.19	0.29**	0.25*	0.45***			
12. Overall II-SRL	4.49	0.54	0.08	0.28**	0.31**	0.12	0.16+	0.43***	0.30**	0.62***	0.65***	0.86***	0.72***		
13. Self-reported implementation of SRL	3.82	0.78	0.01	0.10	−0.13	0.02	0.15+	0.48***	0.21	0.34**	0.27*	0.23*	0.15	0.36***	

+$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; two-tailed; M = mean, SD = standard deviation; II = implementation intention.

competence, reported more positive beliefs about promotion of SRL in class. These results support our fourth hypothesis and indicate that the aspects of teachers' professional competences in SRL that were differentiated in the proposed integrative framework were interrelated but also captured independent competence aspects.

Research Question 2: The Relation of Teachers' Professional Competences in SRL and Their Intention to Implement SRL in the Class as Well as Their Self-Reported SRL Implementation

First, we addressed the relationship between teachers' professional competences of SRL and their intentions to implement SRL in classes. The regression analyses for the overall scores for teachers' intentions to implement SRL (overall II-SRL) in their classes revealed (see **Table 3**) that teachers' self-concept about SRL ($\beta = 0.21$, $p < 0.05$), PCK-SRL ($\beta = 0.22$, $p < 0.05$), teachers' self-efficacy to implement SRL ($\beta = 0.25$, $p < 0.05$), and in tendency teachers' beliefs about the promotion of SRL ($\beta = 0.20$, $p < 0.10$) explained significant amounts of variance in the dependent variable ($R^2 = 0.36$, $p < 0.001$). Thus, it can be stated that teachers' competences as self-regulated learners and teachers' competences as agents for SRL were both statistically significantly related to teachers' intentions to implement SRL in their classes. This relationship can be further examined by considering the intention to implement specific aspects of SRL in classes (see **Tables 4**, **5**).

First, considering teachers' support of students' strategic planning ($R^2 = 0.16$, $p < 0.05$), a statistically significant amount of variance was explained by teachers' PCK-SRL ($\beta = 0.23$, $p < 0.05$). Whereas, for the other aspects of teachers' professional competences as self-regulated learners, no statistically significant relations were found. Next, teachers' instruction of strategy application ($R^2 = 0.21$, $p < 0.01$), teachers' CK-SRL ($\beta = 0.27$, $p < 0.05$), and teachers' self-efficacy to promote SRL in classes ($\beta = 0.26$, $p < 0.05$) accounted for statistically significant amounts of variance. When it comes to teachers' intention to support students' monitoring of their strategy application ($R^2 = 0.30$, $p < 0.001$), teachers' self-concept about SRL ($\beta = 0.30$, $p < 0.01$), and their beliefs about the promotion of SRL ($\beta = 0.28$, $p < 0.05$) statistically significantly amounts of variance in the dependent variable were explained. Finally, looking at teachers' intention to support students' evaluation of their learning process ($R^2 = 0.24$, $p < 0.01$), teachers' self-concept about SRL ($\beta = 0.16$, $p < 0.01$), their implicit theories about SRL ($\beta = 0.29$, $p < 0.01$), and teachers' PCK-SRL ($\beta = 0.27$, $p < 0.05$) accounted for statistically significant amounts of variance. To summarize, higher teachers' professional competences in SRL led to stronger teachers' intentions to implement SRL in classes. The findings support our fifth hypothesis that teachers' competences as learners of SRL and their competences as agents of SRL would be positively related to their intentions to implement SRL in class.

Examining the relationship between teachers' professional competences in SRL and their self-reported implementation of SRL in classes (see **Table 5**), revealed that teachers' PCK-SRL

TABLE 3 | Regression analyses for the intention to implement SRL in class (overall score) and self-reported SRL implementation in class.

Variables	Overall II-SRL				Self-reported implementation of SRL			
	B	*SE B*	β	R^2	*B*	*SE B*	β	R^2
				0.36***				0.33***
Years of service	0.01	0.01	0.14		0.01	0.01	0.17	
Self-concept about SRL	0.16	0.07	0.21*		0.06	0.15	0.05	
Implicit theories about SRL	0.14	0.10	0.15		−0.29	0.18	−0.20	
CK-SRL	0.01	0.02	0.05		0.02	0.03	0.07	
PCK-SRL	0.58	0.26	0.22*		0.99	0.50	0.24*	
Self-efficacy to promote SRL	0.20	0.09	0.25*		0.57	0.15	0.48***	
Beliefs about promotion SRL	0.15	0.08	0.20+		0.11	0.15	0.10	

*+p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001; two-tailed.*

TABLE 4 | Regression analyses for the intention to implement specific aspects of SRL in class (I).

Variables	II strategic planning				II strategy use			
	B	*SE B*	β	R^2	*B*	*SE B*	β	R^2
				0.16*				0.21**
Years of service	0.02	0.01	0.21		0.00	0.01	0.07	
Self-concept about SRL	0.04	0.11	0.04		0.05	0.08	0.06	
Implicit theories about SRL	−0.02	0.15	−0.02		0.04	0.11	0.04	
CK-SRL	−0.03	0.03	−0.12		0.05	0.02	0.27*	
PCK-SRL	0.82	0.41	0.23*		0.19	0.30	0.07	
Self-efficacy to promote SRL	0.17	0.13	0.16		0.22	0.10	0.26*	
Beliefs about promotion SRL	0.20	0.13	0.19		0.08	0.10	0.10	

**p < 0.05, **p < 0.01; two-tailed.*

TABLE 5 | Regression analyses for the intention to implement specific aspects of SRL in class (II).

Variables	II strategy monitoring				II outcome evaluation			
	B	*SE B*	β	R^2	*B*	*SE B*	β	R^2
				0.30***				0.24**
Years of service	0.00	0.01	0.01		0.01	0.01	0.11	
Self-concept about SRL	0.37	0.13	0.30**		0.18	0.12	0.16**	
Implicit theories about SRL	0.17	0.17	0.11		0.39	0.16	0.29**	
CK-SRL	0.01	0.03	0.05		−0.01	0.03	−0.03	
PCK-SRL	0.24	0.46	0.05		1.05	0.43	0.27*	
Self-efficacy to promote SRL	0.18	0.15	0.14		0.22	0.14	0.18	
Beliefs about promotion SRL	0.35	0.15	0.28*		−0.04	0.14	−0.03	

**p < 0.05, **p < 0.01, ***p < 0.001; two-tailed.*

(β = 0.24, $p < 0.01$) and their self-efficacy to promote SRL (β = 0.48, $p < 0.001$) were statistically significantly related to self-reported SRL implementation and explained a significant amount of variance ($R^2 = 0.33$; $p < 0.001$). Overall, the higher teachers' PCK-SRL and their perceived self-efficacy to implement SRL in class, the more often teachers implement SRL in their classroom. This result confirms hypothesis six.

DISCUSSION

Our paper addresses the debate about teachers' professional competences in SRL. Previous research has shown that teacher professional competences in SRL are linked to teachers' classroom practices and students development in SRL (e.g., Wilson and Bai, 2010; Moos and Ringdal, 2012; Spruce and Bol, 2015). However, different approaches were chosen to conceptualize teachers' professional competences in SRL. On the one hand, the focus has been on teachers' competences as agents of SRL, and on the second hand, teachers' experience and competences as self-regulated learners have been emphasized (Randi, 2004; Moos and Ringdal, 2012; Peeters et al., 2014; Yan, 2018). So far, these two theoretical approaches have been unconnected. Referring to general frameworks of teachers' professional competences that distinguish between teachers'

knowledge, beliefs, and motivation (e.g., Shulman, 1987; Kunter et al., 2013; Blömeke et al., 2015) and to findings from empirical studies showing the relevance of these for students' outcomes (Fauth et al., 2019), we introduced in the first part of this paper an integrative framework of teachers' professional competences and instructional practices in SRL (see **Figure 1**). Here, we distinguished between teachers' knowledge, beliefs, and motivation as self-regulated learners and teachers' knowledge, beliefs, and motivation as agents of SRL, together forming teachers' professional competences in SRL (TPC-SRL).

In the second part of our paper, we examined the interplay of teachers' knowledge, beliefs, and motivation about SRL with their intention to implement SRL in class and their self-reported SRL teaching practices. Our first research question addressed the level of teachers' professional competences and the relationship of teachers' knowledge, beliefs, and motivation in both areas of teachers' professional competences in SRL – teachers' competences as self-regulated learners and teachers' competences as agents of SRL. The results partly supported the first hypothesis. We found that teachers had low to moderate knowledge about SRL (CK-SRL and PCK-SRL). Previous research reported that teachers' have very limited knowledge about SRL or even hold misconceptions about SRL (Waeytens et al., 2002; Spruce and Bol, 2015; Dignath and Büttner, 2018; Glogger-Frey et al., 2018). It should be taken into account, that the range of CK-SRL and PCK-SRL was expansive and reached from very little knowledge to higher amounts of knowledge. This is in line with Spruce and Bol (2015), who reported that the teachers varied substantially in the knowledge about SRL. This result also highlights the substantial potential for improving teachers' knowledge about SRL. Since participation in the study was voluntary, one explanation for these results is that teachers who are very interested in the topic took part more frequently. It must also be mentioned, that our CK-SRL instrument is a multiple-choice test that focuses on a more general understanding of SRL. In contrast, other studies partially assessed more specific knowledge, for example, about SRL strategies or metacognition (Zohar, 1999; Spruce and Bol, 2015; Dignath-van Ewijk, 2016). This indicates that different methods assess different aspects of knowledge. Moreover, only a few studies have made an explicit distinction between different areas of knowledge, such as content knowledge (CK-SRL) and pedagogical content knowledge about SRL (PCK-SRL). This distinction is relevant to learn more about why and what measures of promotion are implemented or not implemented in the classroom (see also Research Question 2).

In support of our second hypotheses, we found that teachers held positive beliefs about SRL and showed moderate motivation to act as agents of SRL. These findings agree with previous research that also reported that teachers held positive beliefs and motivations toward SRL (Perry et al., 2008; Lombaerts et al., 2009; Huh and Reigeluth, 2018; Thomas et al., 2020). Further, we hypothesized that teachers would show medium values on the implementation of SRL in class (Hypothesis 3). In general, the results revealed that teachers' implementation intentions toward SRL were positive. Focusing teachers' self-reported implementation of SRL in class showed that teachers reported implementing aspects of SRL in their classroom. However,

the mean values indicated the potential for improvement and more frequent implementation of SRL in classes. Other studies showed that although some SRL aspects were implemented (e.g., more often cognitive strategies than metacognitive strategies) in classrooms, SRL is not yet a fixed component within everyday teaching (e.g., Kistner et al., 2015; Dignath and Büttner, 2018).

Even though there is limited evidence on the interplay of aspects of teachers' competences as self-regulated learners and aspects of teachers' competences as agents of SRL, we expected to find correlations between these competences, as stated in Hypothesis 4. The analyses showed that teachers' self-concept about their SRL was related to their self-efficacy to implement SRL in class. In other words, teachers experience as self-regulated learners and its connected self-concept about their SRL is positively related to their self-efficacy as a teacher to implement SRL in classroom. As researchers mentioned, previous and personal experiences with success and failure might determine a further person's self-efficacy (Tschannen-Moran and Hoy, 2007; Marsh et al., 2019). It can be assumed that teachers' motivational aspects as self-regulated learners are of relevance for their motivational aspects as agents of SRL.

Regarding teachers' beliefs about SRL, we found that more teachers had a growth theory understanding of SRL, the more they reported having positive beliefs regarding the conditions for the promotion of SRL (e.g., students of being able of SRL or teaching of SRL can be well realized at school). This ties-in with the theory's assumption that implicit theories about SRL create a system of meaning that affects how teachers perceive the conditions for the implementation of SRL. Teachers with a growth theory about SRL are more inclined to see SRL as opportunities for students to grow and expand their competences. This agrees with previous researchers that reported that teachers holding more positive beliefs toward SRL also believed that students benefit from SRL more strongly and that a growth-orientated classroom supports student development (De Smul et al., 2019; Bostwick et al., 2020). Further, the few studies focusing on teachers' implicit theories demonstrated that teachers' growth theory might also influence their interactions with students and their behavior in the classroom (Rattan et al., 2012; Zeeb et al., 2020). Thus, it might be important for further studies to address teachers' implicit theories about SRL, their SRL practices and students' development in SRL. In addition, we found a positive relationship between implicit theories about SRL and CK-SRL, indicating that teachers with a growth theory of SRL reached higher scores on the CK-SRL test. This result agrees with previous studies that reported growth theory is positively related to higher knowledge about SRL (e.g., Karlen and Compagnoni, 2017). It might be promising for future research to investigate the role of (pre-service) teachers' growth theory and how they are related to teachers' other aspects of teachers' professional competences and competence development in SRL.

Our second research question examined the relationship between several aspects of teachers' professional competences in SRL and their intention to implement SRL in classes, as well as their self-reported SRL implementation. Studies have reported inconsistent linkages between teachers' professional competences and (self-reported) implementation of SRL (Kistner et al., 2015;

Spruce and Bol, 2015; De Smul et al., 2019) and only limited results concerning the importance of their competences as self-regulated learners for the implementation of SRL can be found (Gordon et al., 2007). Looking at the relationship between aspects of teachers' professional competences in SRL with their intentions to implement SRL in class, our findings highlight the relevance of particular competence aspects from both competence areas (i.e., as self-regulated learners and as agents of SRL). This supported our fifth hypothesis. However, we also observed different patterns of relationships between teachers' professional competences in SRL and the intention to implement particular SRL strategies in class. For example, beliefs about promoting SRL was a positive predictor for intention to implement strategy monitoring in classes, but not for the other implementation intentions. This supports findings by Kistner et al. (2015), who likewise found differential correlational patterns between beliefs and the teaching of SRL strategies. In addition, our results revealed that both knowledge components identified relationships with self-reported intentions to implement SRL in classes. PCK-SRL was a positive predictor of the intention to implement SRL (overall score) and for the intention to implement strategic planning and outcome evaluation in classes. In contrast, CK-SRL only positively predicted the intention to implement strategy use in classes. This finding agrees with research emphasizing that PCK explain a higher amount of variance in teachers' actions than CK (Förtsch et al., 2016; Yang et al., 2020).

With a focus on teachers' self-reported implementation of SRL in classes (Hypothesis 6), PCK-SRL and self-efficacy to implement SRL were the only two statistically significant predictors. This supports previous research that highlighted the importance of self-efficacy for the self-reported implementation of SRL (Chatzistamatiou et al., 2014; Peeters et al., 2014). Even though Dignath-van Ewijk (2016) found teachers' self-efficacy regarding the promotion of SRL to have much higher predictive power for teachers' SRL instructional practices than their content knowledge or beliefs, our results indicate that a teacher's PCK-SRL is related to their teaching practice. However, when we look at studies from other domains (e.g., Math), PCK becomes of great importance for explaining teachers' instructional practices (e.g., Backfisch et al., 2020). This emphasizes that a clear distinction between CK-SRL and PCK-SRL should be made.

Limitation of Study and Future Outlooks

When interpreting the results of our study, several limitations must be considered. First, regarding the data presented in this paper, the small sample size and the cross-sectional design should be addressed. Due to the small sample size of only 106 teachers, the results from the statistical analyses should be interpreted with caution and need to be corroborated using a larger dataset. The cross-sectional design allowed for an examination of relations, but it did not account for causal inferences. Thus, conclusions about the direction of effects cannot be drawn. However, we can build on results from previous research when it comes to concluding on the direction of the reported effects. Further studies will have to replicate our results. Longitudinal studies would help to shed light on

the development of teachers' professional competences in SRL throughout different stages of the teacher career. In addition, a longitudinal approach could lead to a deeper understanding of the role of teachers' competences as self-regulated learners and in the development of teachers' competences as agents of SRL. More precisely, it could be examined if teachers' competences as self-regulated learners are a precondition for the development of teachers' competences as agents of SRL. Moreover, intervention studies focusing on the two presented aspects of teachers' professional competences in SRL could provide deeper insights into understanding how teachers' competences in SRL can be fostered (Kramarski, 2018).

Second, we used self-report measures to assess teachers' implementation of SRL in classes. We included teachers' intention to implement SRL because it represents teachers' attitudes toward implementation (Steinbach and Stoeger, 2016). Even though teachers' implementation intention toward learning influences their teaching behavior (Vandevelde et al., 2012), this relation is not conclusive. Teachers might be genuinely interested in implementing various aspects of SRL but unable to do so (e.g., lack of competences, contextual factors; Waeytens et al., 2002; Peeters et al., 2016). The second self-report approach that we used allows for a broader view of teachers SRL implementation by asking if they have implemented SRL related structures in classes. This scale was moderately related to the global measure of the intention to implement SRL, indicating that those are related but distinct aspects of SRL implementation. This is of particular relevance because the relationships between teachers' professional competences in SRL and their SRL implementation might vary due to how professional competence and SRL practices of teachers are assessed (Zohar et al., 2001; Darmawan et al., 2020). Further, it has been reported that teachers' self-reports of their promotion of SRL do not necessarily correlate with classroom observations of teachers' SRL instruction (Dignath and Büttner, 2018). This is not surprising, as different measurement instruments are used to capture different aspects or perspectives of implementation (Patrick and Middleton, 2002). Self-reported implementation of SRL more likely reflects teachers' perception of their habitual behavior. For example, behaviors that occur over several school weeks may differ from one-time observations of the teachers' classroom behavior. Data gathered from observing teachers can supplement teachers' self-reported data by providing other perspectives on their promotion of SRL in classes. For this reason, it is essential that future studies also assess teachers' actual actions in class (e.g., recording lessons) and combining them with different measurement methods. Finally, it should be noted that our study has not yet been able to examine the entire model from Part 1 (**Figure 1**). This will require future studies that collect data from both teachers and students.

Future studies should align teachers' competences and instructional practices in SRL with students' gains in SRL and academic achievement. Few studies have assessed the associations of SRL instructions with students' learning outcomes (e.g., Zepeda et al., 2019). This would help to gain new insights into the adaptiveness and effectiveness of teachers' approaches to promoting SRL in classes. Furthermore, few studies have

investigated teachers' SRL instructional practices and their interplay with aspects of teacher competences as self-regulated learners and as agents of SRL (i.e., CK-SRL and PCK-SRL). Gaining a deeper understanding of the relevance of particular aspects of teachers' professional competences in SRL to specific SRL instructional practices as well as to the effects on students' SRL development and engagement in SRL would be beneficial to develop more specific teachers' trainings. To support teachers in SRL instruction, trainings are needed that not only support teachers in developing SRL classrooms and translating SRL into real practice but also take into account teachers' prior conceptions and experiences of SRL (Perry et al., 2008; Bembenutty et al., 2015; Kramarski, 2018; Xu and Ko, 2019). Finally, even though studies have reported only small amounts of variance in teaching SRL, explained by variables at school or context levels, these aspects could nevertheless help to better understand why teachers do or do not foster SRL in class (Vandevelde et al., 2012; De Smul et al., 2019; Thomas et al., 2020). One promising approach might be to assess the impact of collective teacher efficacy, job resources, and school climate (i.e., innovative culture; Goddard et al., 2000; Cuyvers et al., 2020; Thomas et al., 2020).

CONCLUSION

In Part I of this paper, we introduced a new integrative framework of teachers' professional competences and instructional practices in SRL. The proposed model emphasizes the relevance of teachers' knowledge, beliefs, and motivation in two areas of competence: teachers' competences as self-regulated learners and teachers' competences as agents of SRL. Combined, these two areas of competences form teachers' professional competences in SRL, which, in turn, are expected to impact teachers' SRL instruction in everyday classes and students' development of SRL. This integrated and holistic approach allows for differentiated analyses of particular aspects of teachers' professional competences in SRL. It also supports the process of deeply understanding why and how teachers promote SRL in classes and which competences and teaching practices support students' SRL.

In Part II of this paper, we provided first empirical evidence for the relationships between teachers' competences as self-regulated learners and as agents of SRL. The reported results highlight the importance of differentiating between teachers' knowledge, beliefs, and motivation as well as between teachers' competences as self-regulated learners and teachers' competences as agents of SRL when examining teachers' SRL implementation in classes. We were able to disentangle the effects of these aspects and areas of teachers' professional competences in SRL. The results also highlight the importance of separating teachers' knowledge about SRL into CK-SRL and PCK-SRL. Our results have implications for future studies on teachers' professional competences in SRL in at least two ways. Firstly, future research might explore in greater depth the interplay of the two competence areas and their relations to teachers' SRL instruction in classes. Secondly, our findings promote the development of teacher training programs aimed at fostering teachers' professional competences as self-regulated learners and as agents of SRL.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the data are not made available for reasons of data protection. Requests to access the datasets should be directed to yves.karlen@fhnw.ch.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Applied Sciences and Arts Northwestern Switzerland FHNW. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

YK conducted the literature review, analyzed the data, conceptualized the manuscript, drafted, and revised the manuscript. SH supervised analysis, conceptualized the manuscript, drafted, and revised the manuscript. CH curated the data, conceptualized the manuscript, and commented on the development of the manuscript. All authors contributed to the article and approved the submitted version.

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APPENDIX

Self-Concept About SRL

- I am good at self-regulating my learning.
- I can self-regulate my learning well.
- It is easy for me to self-regulate my learning.

Self-Efficacy to Promote SRL

- I can successfully teach students different strategies for self-regulated learning.
- I have the confidence to explain to the students when and how strategies for self-regulated learning can be used effectively.
- I am confident that I can show the students how to use strategies for self-regulated learning.