

# **An Overview of Instruments for Assessing and Supporting Elementary School Students' Self-Regulated Learning**

Marika Koivuniemi<sup>a\*</sup>, Hanna Järvenoja<sup>a</sup>, Sanna Järvelä<sup>a</sup> and Valérie Thomas<sup>b</sup>

*<sup>a</sup>Learning and Educational Technology Research Unit (LET). Department of Educational Sciences, University of Oulu, Finland;*

*<sup>b</sup>Faculty of Psychology and Educational Sciences, Department of Educational Sciences, Vrije Universiteit Brussel, Belgium.*

\*corresponding author:

Contact information (corresponding author): Marika Koivuniemi, Department of Educational Sciences and Teacher Education, University of Oulu, P.O. Box 2000, University of Oulu FIN-90014, Finland. Email: [marika.koivuniemi@oulu.fi](mailto:marika.koivuniemi@oulu.fi).

Marika Koivuniemi, is a PhD student at the Learning and Educational Technology research unit in Department of Educational Sciences in University of Oulu. Koivuniemi's research interest is in the field of self-regulated learning, and especially on the ways, how these skills can be applied and supported in practice.

co-authors:

Hanna Järvenoja, e-mail: [hanna.jarvenoja@oulu.fi](mailto:hanna.jarvenoja@oulu.fi).

Hanna Järvenoja is Associate Professor at the University of Oulu. Järvenoja's research interest is in the field of self-regulated learning, particularly motivation and emotion and their regulation in individual and social levels, socially shared regulation processes in collaborative learning, technology enhanced learning and supporting regulation of learning with technological tools. She has published in international refereed journals and is actively involved in international research networks, such as European Association for Learning and Instruction (EARLI).

Sanna Järvelä, e-mail: [sanna.jarvela@oulu.fi](mailto:sanna.jarvela@oulu.fi).

Sanna Järvelä is a professor in the field of learning and educational technology and a head of the Learning and Educational Technology Research Unit (LET) (<http://www.oulu.fi/let>). Järvelä and her research group is internationally well known from theoretical advancement of social aspects

self-regulated learning (SSRL). Her interdisciplinary research work has strong contribution to the methodological development of process oriented research methods in the field of learning and collaboration and recently applying of multimodal methods in self-regulated learning research. She is the chief editor of International Journal of Computer Supported Collaborative Learning (iCSCL). and invited member of the expert group of the OECD's PISA 2024 'Learning in the Digital World'. Järvelä has published more than 150 peer-reviewed journal articles and her google scholar h-index is 55.

Valérie Thomas, e-mail: [valerie.thomas@vub.be](mailto:valerie.thomas@vub.be)

Valérie Thomas works as a postdoctoral researcher at the Department of Educational Sciences of the Vrije Universiteit Brussel. Her research focuses on self-regulated learning, promotion of self-regulated learning in elementary and lower secondary education and the role of parental involvement in education.

# **An Overview of Instruments for Assessing and Supporting Elementary School Students' Self-Regulated Learning**

This study summarises existing instruments for measuring and supporting self-regulated learning (SRL) in schools using articles from the SCOPUS and Web of Science databases. We analyse how the instruments address cognition, motivation or emotions as a target for regulation and whether they acknowledge the phase of SRL (forethought, performance or reflection) that is used. The results show that the instruments accurately specified the SRL target/s, although the regulation phase was specified only 32.7% of the time. Moreover, the SRL assessment instruments measured students' cognition and motivation, whereas support focused only on cognitive processes. If SRL instruments are intended for future pedagogical use, supports that explicitly target motivation and emotion and acknowledge the differences between SRL phases should be designed.

Keywords: SRL; self-regulated learning; supports; instruments; assessment

## **Introduction**

When students do not have the skills or knowledge to complete a learning task, they confront challenges that need to be addressed in order for them to continue learning (Koivuniemi et al., 2017). These challenges can have several origins, often related to students' cognition (Koivuniemi et al., 2017), motivation, and emotions (Boekaerts & Pekrun, 2015; Pekrun et al., 2007), and they have the potential to promote learning if they prompt students to work harder, adapt strategic behaviours, or adjust learning goals (Salomon & Perkins, 1998). However, they may also lead to poorly integrated knowledge, negative emotions, and counterproductive motivational outcomes (Boekaerts & Pekrun, 2015; Rajabi, 2012; Zimmerman, 2002).

Overcoming these learning challenges requires self-regulated learning (SRL) skills (Winne & Hadwin, 2008; Zimmerman, 2002), which allow students to recognise and actively regulate their learning using techniques such as setting goals and plans, using different strategies and monitoring, and reflecting on their learning progress (Winne & Hadwin, 2008). Students' SRL is not always easy or self-evident (Borkowski & Thorpe, 1994; Zimmerman, 2002), and teachers need to provide opportunities for students to learn behaviour regulation and support SRL (Randi & Corno, 2000).

Teacher support is especially needed among younger students, whose ability to comprehend their own thinking and behaviour is not as developed as older students (Perry & VandeKamp, 2000; Winne, 1997).

Teachers may find it challenging to provide support for SRL, as it requires a deep, theory-based understanding of SRL phases and processes and practical skills. Moreover, many teachers are not aware of the different tools available for the implementation of SRL in practice. More information is needed about assessment, translation of understanding for support practice, and the methods available for elementary school levels. Hence, this study collected different instruments designed to assess or support SRL and aims to provide a theory-driven overview of how they address students' SRL.

### **Self-Regulated Learning**

Self-regulated learning is a process by which students systematically organise their thoughts, feelings, and actions to achieve learning goals (Usher & Schunk, 2017). It is a cyclical process involving several phases that follow one another in a strategic manner (Winne & Hadwin, 2008; Zimmerman, 2002). The SRL cycle begins with the *forethought phase*, focusing on understanding the learning task, setting goals, and creating strategic work plans (Zimmerman, 2002). In the *performance phase*, learners monitor their learning processes and adapt their behaviours to achieve plans and goals (Zimmerman, 2002). This strategic activity requires metacognitive awareness (Rajabi, 2012; Winne, 2018) where students actively monitor their behaviour by tracking personal activities, such as working behaviours, amount of study time, or successfulness during the task (Zimmerman, 2002). In the *reflection phase*, students evaluate their work and achievements or learn to use adaptive responses to solve future learning challenges (Cleary & Zimmerman, 2012; Winne & Hadwin, 2008).

In SRL, different cognitive, motivational, and emotional learning aspects are interrelated (Boekaerts & Pekrun, 2015; Zimmerman, 2002). The cognitive learning process includes strategic

student actions and knowledge, such as systematic ways of generating problem-solving steps while performing a task (Veenman et al., 2006) or using different cognitive strategies, such as rehearsal, elaboration, and organisation to memorise new knowledge (Pintrich & De Groot, 1990). These skills are usually connected to students' learning performance (Pintrich & De Groot, 1990). However, the development of different cognitive and metacognitive learning skills is not straightforward and depends on the ways in which these strategic actions are supported (Hattie et al., 1996).

Motivation refers to students' desire to learn (Randi & Corno, 2000) and is affected by different contextual factors and affective reactions, in addition to the subjective appraisals students make in learning situations (Boekaerts & Niemivirta, 2000). Different motivational aspects, such as self-efficacy beliefs, success and failure experiences, and goals and beliefs about the importance of the task influence students' desires to use SRL (Pintrich & De Groot, 1990). Motivation can be a target for regulation, indicating that different motivation regulation strategies can be used to modify, change, or maintain motivation to learn (Wolters, 2003).

In academic settings, students may experience enjoyment of learning, hope for success, or anger, boredom, and fear about different task demands (Boekaerts & Pekrun, 2015). These different emotions can be the target of regulation, indicating that students actively monitor, evaluate, and change the occurrence, intensity, or duration of different emotional experiences and reactions (Schutz et al., 2006). For instance, by regulating their own emotions, students can influence the activation and use of appropriate learning strategies, which can be linked to the development of executive cognitive functioning, including working memory, inhibitory control, and mental flexibility, and in turn, is further linked to students' metacognitive thinking and cognitive strategy use (Boekaerts & Pekrun, 2015; Winne, 2018).

### **Assessing Self-Regulated Learning**

Students' SRL skills have been widely assessed via subjective self-reports, such as questionnaires, interviews, and think-aloud protocols (Panadero, Klug, & Järvelä, 2016; Winne & Perry, 2000). Aspects of students' cognitive, metacognitive, motivational, and emotional learning have been studied in detail using these SRL instruments (Pintrich & De Groot, 1990), which allow researchers to consider different aspects of students' SRL use (González-Torres & Fermin, 2008; Pintrich et al., 2000), assess general aptitudes or tendencies to activate different SRL processes (Pintrich et al., 2000), but also to provide valuable information for teachers and researchers about students' metacognitive judgements (Winne, 2017).

If SRL assessment instruments are well planned and connected to tailored SRL supports, they can support SRL supportive classroom practices (Panadero, Klug, & Järvelä, 2016). For example, Azevedo and Cromley (2004) used an interventional study addressing SRL training effects on students' learning in a hypermedia environment, in which knowledge was measured with pre- and post-tests. The learning process was visualised via a think-aloud protocol. This combination allowed researchers to visualise the effects of different SRL training forms on students' SRL use and helped them increase their understanding of a learning topic. In regular classroom contexts, this information could be used to design more effective SRL supports by covering all SRL phases. Systematic information about SRL use could help students reset learning goals and plans in the forethought phase, make changes to the selected learning strategies during the performance phase, or even learn from their mistakes and apply this thinking to future learning situations (Cleary & Zimmerman, 2012; Zimmerman, 2002).

### **Supporting Self-Regulated Learning**

By assessing students' SRL, it is possible to promote their active regulation of learning (Winne, 2017; Winne & Perry, 2000). This is because self-evaluations promote metacognitive awareness of SRL processes, if supported properly (Panadero et al., 2016). The support for recognising students'

own learning behaviours can be provided in various ways, either through indirect learning experiences or by direct teaching of these skills (Paris & Paris, 2001). Indirect SRL supports promote students' SRL use through real-life or repeated experiences in school, which can help students realise the usefulness of repeated work habits (Paris & Paris, 2001). For example, Rajabi (2012) describes ways that SRL support could direct students towards SRL through learning materials using step-by-step instruction, which allows students to see the benefits of this way of working, helping them develop SRL skills in a concrete way.

SRL can also be supported by directly teaching it or elicited through practice (Devolder et al., 2012; Paris & Paris, 2001), as shown in Perry's (1998) study, which used different SRL support classroom practices. Here, students were given the opportunity to address the challenges of completing tasks and were then asked to evaluate their own work, as well as that of their peers. Teachers also offered support by ensuring that students had the strategic knowledge required to work independently, helping them make appropriate choices, encouraging them to expand their abilities by attempting challenging tasks, using non-threatening evaluation practices that emphasise personal progress, and encouraging students to interpret errors as learning opportunities.

Previous studies have shown the usefulness of supporting students' SRL skills in school settings (Devolder et al., 2012; Winters et al., 2008). For example, progress in SRL can be identified when students have received instrumental support from their peers and teachers in the form of SRL-associated modelling and scaffolding attitudes and actions (Perry et al., 2007). Computer-based learning environments can also provide effective support for individual student SRL processes (Devolder et al., 2012).

### **SRL Assessment and Support for School Practice**

In this study, the different methods and tools used to assess and support students' SRL are referred to as *SRL instruments*. Both SRL assessment and support instruments can be effective for students' SRL development if their purpose and use is well-established (Dignath & Büttner, 2008; Winne,

2017). Whereas SRL assessment instruments offer important information about students' current SRL skills for teachers, researchers, and the students themselves, SRL support instruments can help create learning environments that enable systematic development of students' future SRL skills. However, more needs to be done to make SRL instruments more efficient and useful for practical purposes (Devolder et al., 2012; Dignath & Büttner, 2008).

First, prior studies have emphasised that students' SRL should be supported as early as possible (Perry, 1998; Perry & VandeKamp, 2000), suggesting that a focus on SRL skill development at the elementary school level is needed. A meta-analysis that examined the effects of different interventions on student learning skills showed that learning skills training had a stronger effect on learning skills for primary school students than for older secondary school students (Hattie et al., 1996). A meta-analysis focusing on the impact of learning skills training on students' academic performance and SRL by Dignath and Büttner (2008) found that primary school students struggled more with the metacognitive and cognitive aspects of learning, while older secondary school students struggled more with motivational issues. In general, SRL research has also shown how motivation and emotion are important for both learning and cognitive functions for students of different ages (Boekaerts & Pekrun, 2015; Pintrich & De Groot, 1990; Wolters, 2003). These studies suggest that SRL instruments should have a varied focus and structure that responds to the specific needs of students of different ages (Dignath & Büttner, 2008).

Second, SRL complexity requires detailed information on how different SRL targets and phases should be considered when SRL instruments are planned. Additionally, the role of feedback practices should also be considered, as these have been found to be an essential part of SRL development (Randi & Corno, 2000). Feedback raises student awareness and helps them make conscious choices about their strategic and adaptive actions (Butler & Winne, 1995; Panadero, Jonsson, & Strijbos, 2016; Usher & Schunk, 2017). Combining relevant feedback practices with



SRL support practices to increase students' awareness of their learning processes and challenges makes it possible to optimise the usefulness of these SRL supports.

To support students' SRL skills at the elementary school level, more information about the existing SRL instruments is still needed. A wide range of instruments exist that either build on SRL theories and explicitly target (some aspects of) an SRL process or phase, or that do not directly relate to SRL or learning, but target psychological components of self-regulation (e.g., emotion regulation) and in doing so, relate to some aspect of SRL. Until now, this information has not been collected. An overview of existing instruments that outlines their focus, structure, and relationship to SRL would help researchers and practitioners comprehend the types of instruments that already exist, determine what elements they omit, and consider what is needed for future SRL. Hence, the aim of this study is to explore different qualities of existing SRL instruments, particularly those targeted at elementary school levels (covering primary school, middle school, and secondary school). The specific research questions include: (1) How are the different SRL targets (cognition, motivation, emotions) and phases (forethought, performance, reflection) covered in existing SRL instruments? and (2) How do SRL support and assessment instruments differ?

## **Methods**

### ***Inclusion Criteria***

The existing SRL instruments were electronically obtained from scientific journal articles in which each instrument had a theoretical framework that either implemented a particular SRL theory (Winne & Hadwin, 2008; Zimmerman, 2002) or was implemented in a study that relied on the SRL framework. Two databases known for encompassing high-impact and high-quality journals (SCOPUS and Web of Science) were used for article searches. The search was limited to peer-reviewed, English-language, empirical research articles.

The literature search focused on journal articles that included two parameters: (1) individual student regulation of learning or SRL and (2) introducing or implementing an SRL instrument that aimed to assess, measure, support, and/or prompt SRL skills. Accordingly, the following search queries were used: ((regulat\* AND learn\*) OR SRL) AND (assess\* OR measur\* OR tool\*) AND (support\* OR promot\* OR instru\*). Search queries were targeted to search these terms from the title, abstract, and/or body of the article. The initial search resulted in a total of 1,986 research articles.

### ***Article Selection***

The article selection was conducted through five selection rounds (Figure 1): (1) exclusion of all duplicated papers (395 articles excluded); (2) selection by title-level screening; all articles that did not meet the selection criterion were excluded (696 articles); (3) exclusion of papers where the full text was unavailable (140 articles); (4) abstract level screening (539 articles); and (5) all remaining articles and instruments were fully reviewed (108 articles excluded). The selection criterion for each round were the same. Articles were excluded if these parameters were not met:

- (1) the study did not focus on different aspects on SRL (cognition, motivation, or emotion) or it focused on non-topic issues, such as politics or learning disabilities;
- (2) the study did not include any SRL assessment instruments;
- (3) the study was conducted in kindergarten or higher education;
- (4) the study focused on group processes;
- (5) students' SRL skills were not studied in educational settings; and
- (6) the full study text was not available.

This process resulted in a total of 108 articles in which a total of 161 instruments were found. All SRL instruments found were listed with their names, aims, and instrument sources. Every identified instrument was listed once, regardless of the frequency (*f*) of its use.

## *Analysis*

The listed instruments were categorised according to the five different criteria: (1) *SRL targets*; (2) *SRL phases*; (3) *instrument type*; (4) *feedback*; and (5) *instrument user* (Figure 2). The first two criteria describe the instrument's SRL content and were derived from SRL theory (Zimmerman, 2002). The remaining criteria describe the format of the SRL instrument.

Criterion 1 focused on SRL target(s) of the regulation processes. Three sub-codes were used: (1) *cognition*, (2) *motivation*, and (3) *emotional*. Instruments that focused on assessing or supporting students' task understanding, prior knowledge, cognitive strategy use, planning, or metacognitive aspects of learning were coded to the cognition sub-category. Instruments that focused on assessing or supporting motivational SRL aspects, such as goal orientation, self-efficacy, attributions, and motivational regulation, were coded to the motivation sub-category. Instruments that targeted students' emotional regulation strategies or feelings were coded to the emotion sub-category. The coding was not exclusive, and it was possible to code one instrument into several categories.

Criterion 2 focused on the SRL phase. For this purpose, Zimmerman's (2002) SRL model was used. Codes included three phases: (1) *forethought*; (2) *performance*; and (3) *reflection*. Instruments that measured or supported students' regulated learning, such as goal setting, strategic planning, and task understanding, at the beginning of the learning process were coded to the *forethought* phase. Instruments used in the middle of the learning process, which measured or supported students' strategic activities, were coded to the *performance* phase. Finally, instruments used at the end of the learning process to measure or support students' self-reflection and adaptation were coded to the *reflection* phase. If the instrument was used in several SRL phases, all relevant categories were applied in the coding. If it was unclear for which specific phase(s) the instrument was implemented, the SRL phase coding received a value of 0.

The third criterion defined the type of the instrument. Two different types of instruments were found: (1) *SRL assessment* and (2) *SRL support*. SRL assessment instruments were usually

assessed with different questionnaires and observation forms that addressed students' SRL skills. SRL support instruments included practical instructions, methodologies, or scripts that set a clear structure for teachers and students, as well as different technological tools to guide students' SRL. These aimed to support students' SRL skills by asking students, for example, to plan or evaluate their work.

The fourth criterion was the *feedback* component of the instrument. The instrument was placed in the feedback category if a student was provided with any feedback, either on their actualised SRL process or on subjective interpretations of them. The feedback was usually targeted at students' products, behaviour of teachers, researchers, or SRL instruments. If the instrument provided generalised feedback (static prompts) that was similar for everyone regardless of whether the user needed it or not, the instrument was not considered in this coding.

The fifth criterion was the *user of the instrument*. Two codes were used: (1) *student* and (2) *other*. The person answering the instrument questions or doing the tasks was coded as the user; *other* included teachers and researchers who were, for example, evaluating and/or observing students' behaviours through different SRL instruments.

[Figure 2. Near here.]

Cohen's kappa was used to determine the interrater reliability (Belur et al., 2018). Before reliability coding, the researchers discussed the definitions for the categories to be coded and agreed on rules to follow when conducting reliability coding. After that, two independent researchers double-coded 34% of the data. In the SRL targets, substantial agreement was reached for cognition ( $\kappa = 0.712$ ), motivation ( $\kappa = 0.686$ ), and emotions ( $\kappa = 0.719$ ). In the SRL phases, almost perfect agreement was reached for the forethought ( $\kappa = 0.818$ ) and reflection ( $\kappa = 0.915$ ) phases, and substantial agreement was reached for the performance phase ( $\kappa = 0.803$ ). Substantial agreement

was reached for the instrument type ( $\kappa = 0.730$ ) and almost perfect agreement for the feedback ( $\kappa = 0.818$ ) and instrument user ( $\kappa = 1.0$ ) coding. Finally, contradictory findings were discussed until full consensus was reached.

## Results

### *How are the Different SRL Targets and Phases Covered in Existing SRL Instruments?*

The results and found frequencies ( $f$ ) related to the first research question are presented in Table 1. The results show that all three targets for regulation, cognition, motivation, and emotions were addressed together with more than one SRL assessment and support instrument (criteria 1). The majority of the instruments targeted regulation of motivation or cognition ( $f = 104$ , 64.6% versus 100, 62.1%). Instruments assessing or supporting the emotional SRL aspects were less common ( $f = 18$ , 11.2%).

Regarding SRL phases (criteria 2), for the majority of the SRL instruments, it was not possible to determine which phase of the SRL process they were targeting ( $f = 109$ , 67.3%). The three different phases were equally represented in the instruments in which SRL phases were identifiable: (1) forethought in 21.1% of the cases ( $f = 34$ ); (2) performance in 24.2% of the cases ( $f = 39$ ); and (3) reflection in 24.8% of the cases ( $f = 40$ ).

When SRL phases were compared to SRL targets, instruments targeting motivational and emotional aspects remained disconnected from different SRL phases. Instead, almost half of the instruments ( $f = 44$ ) focusing on cognitive aspects were connected to an SRL phase. In addition, when the instrument clearly addressed the SRL phase, it was usually used in more than one phase.

[Table 1 Near here]

## ***How do SRL Support and Assessment Instruments Differ?***

### *Instrument type.*

Most of the SRL instruments were designed to assess students' SRL ( $f = 131$ , 80.7%). These instruments had a theoretical background that relied on a specific SRL theory. Fewer instruments were related to other theoretical constructs, such as motivation orientation, attitudes, feelings, and/or task performance-related issues, but the data they yielded were used in relation to the analysis of students' SRL assessments.

SRL assessment instruments consisted primarily of different kinds of questionnaires and self-reports ( $f = 122$ ). The most used instruments were the Motivated Strategies for Learning Questionnaire ([MSLQ]  $f = 21$ ) and the Patterns of Adaptive Learning Survey ([PALS]  $f = 4$ ) shown in Appendix 1. Different think-aloud measures ( $f = 3$ ), observation tools ( $f = 4$ ), and learning diaries ( $f = 1$ ) were also found in SRL assessment types, but their use was low.

SRL support instruments were less common ( $f = 31$ , 19.3%). All of the instruments were directly based on a specific SRL model and consequently had a solid theoretical background. The most frequently mentioned SRL support instruments were Self-Regulated Strategy Development ([SRSD]  $f = 5$ ) and IMPROVE methods ( $f = 2$ ), which are shown in Appendix 1. Self-regulated learning support instruments consist of two different types of supports: (1) technological ( $f = 10$ ) and (2) practical SRL instruction ( $f = 21$ ). During technological support, students' learning was usually guided through different computer- and web-based solutions. Practical SRL instructions usually offered step-by-step guidance, which was done with carefully planned scripts or task structures for SRL use in regular classroom situations.

### *SRL targets.*

The SRL assessment instruments were designed specifically to tap motivational SRL aspects ( $f = 95$ , 72.5%) followed by cognitive aspects ( $f = 71$ , 54.2%) and less so students' emotional SRL

aspects ( $f = 17$ , 12.9%). Assessment instruments targeted different motivational aspects, such as self-efficacy, value components, goal orientation, and persistence. Appropriate examples of this type of instrument are the Self-Efficacy Scale (SESC) (e.g., Totan, 2014), MSLQ (e.g., Ziegler, 2014), and Students' Adaptive Learning Engagement in Science questionnaire (SALES) (e.g., Bedford, 2017). Students' cognitive and metacognitive thinking were also widely covered, and themes related to students' resource management strategies, effort regulation, help seeking, and cognitive and metacognitive strategy use, such as rehearsal, elaboration, organisation, crucial thinking, and metacognitive self-regulation, were widely covered using different instruments such as the MSLQ (e.g., Ziegler, 2014) and Learning Strategies questionnaire (Neber et al., 2008). Assessment instruments focusing on students' emotions addressed students' emotional states or awareness in different situations, emotional engagement, and SRL use during different emotional states. Appropriate examples of these instruments are Difficulties in Emotion Regulation Scale (DERS) described by Metz et al. (2013) and Achievement Emotion Questionnaire in Mathematics (AEQ-M) described by Kim et al. (2015).

SRL support instruments were typically designed to support students' cognitive aspects of learning ( $f = 30$ , 96.8%). Motivational and emotional aspects ( $f = 9$ , 30% and 1, 3.3%, respectively) were less targeted. Cognitive supports were related to students' task understanding, background knowledge building, goal setting, planning, strategy use, and reflection. An appropriate example of this type of instrument is the SRSD (e.g., Festas et al., 2015). Motivational supports are usually related to students' motivation regulation strategy use in various ways. For example, in the IMPROVE method (e.g., Michalsky, 2013), students' awareness of motivational beliefs, such as self-efficacy, outcome expectations, intrinsic interests, and values, was supported. Support in these instruments was usually conducted through different motivation-related self-metacognitive questioning, such as: What is your motivation for solving the problem/task? What will you do if you run into difficulties? Emotional support was almost non-existent in the SRL support

instruments. One identified example was the Learning to BREATHE programme, which is a mindfulness-based training programme designed to facilitate the development of emotion regulation and attention skills for middle- and high-school students (Metz et al., 2013). In this program, students learn to recognise and understand their thoughts and feelings and learn different ways to regulate emotions.

### *SRL phases.*

Typically, SRL assessment instruments do not describe in detail whether they were used during a certain SRL phase. The forethought phase was identified in 8.4% of the cases ( $f= 11$ ), performance phase in 9.9% of the cases ( $f= 13$ ), and reflection phase in 9.9% ( $f= 13$ ). When phase/s were identified, the assessment instruments were used as an “in-the-moment measure”. For example, in the microanalytic processes measure of self-regulated learning (DiBenedetto & Zimmerman, 2013), short questions were timed in certain phases of learning. A similar process was followed with the think-aloud protocols, which showed even more detailed process data about students’ SRL behaviour (e.g., Greene et al., 2015).

In SRL support instruments, the forethought phase was identified in 74.1% of the cases ( $f= 23$ ), performance phase in 83.9% ( $f= 26$ ), and reflection phase in 87.1% ( $f= 27$ ). From the identified SRL support instruments 71% ( $f= 22$ ), students’ SRL skills during all phases of SRL were supported. In these instruments, the teacher, researcher, and/or technology supported students’ SRL use via step-by-step instruction. Smaller numbers of instruments focused on supporting students’ learning in one or two different SRL phases ( $f= 6$ , 19.4%). In these instruments, the focus addressed certain SRL processes, such as goal setting and planning, strategies, and/or reflection on learning tasks. Appropriate examples of this type of instrument were Betty’s brain (Roscoe et al., 2013) and Script and Rubric (e.g., Panadero et al., 2012).



### *Feedback.*

Typically, SRL assessment instruments did not provide any student feedback. In comparison, over half of the support instruments offered feedback with either technological support and/or prompts ( $f= 8, 47.1\%$ ) or through practical SRL instructions ( $f= 9, 52.9\%$ ) addressing student learning behaviours and progress ( $f= 17, 56.7\%$ ). With the technological solutions, feedback was given to students via a virtual teacher or mentor who provided help and feedback to the students (as an example). Built-in guidance systems that informed the student about the correctness of the task were also used. Through practical SRL instructions, students were provided with feedback through reflective question prompts or conversations with teachers regarding their working methods and progress.

### *Instrument user.*

The majority of the SRL assessment instrument users were students ( $f= 126, 95.5\%$ ). In these instruments, carefully designed questions guided students to give their own subjective descriptions of their learning behaviours. However, some of the SRL assessment instruments were based on teachers' or researchers' objective observations, which were designed to assess students' SRL activity either generally or instantly ( $f= 6, 4.5\%$ ).

Students were the main users of SRL support instruments, and they actively followed the instructions offered to them by the instrument. However, teachers' roles were not completely overlooked. For example, in the technological SRL supports, students typically worked independently in conjunction with active teacher guidance and support, which included helping students to monitor their learning, understand the feedback, or simply use the technology (e.g., Festas et al., 2015; Meyer et al., 2010). To enable this type of learning, teacher training and involvement in instrument design is also important (Meyer et al., 2010; Roscoe et al., 2013).

Teachers' roles seemed to be important, when using practical SRL instructions. Teachers were usually seen as active participants whose role was vital to supporting students' SRL. For

example, teachers were sometimes responsible for implementing different SRL-supportive practice steps, such as helping students build background knowledge, make work plans, and model strategic student actions. Teachers played a vital role in supporting students' strategy use in ways similar to those in a classroom-based strategy intervention (Andrzejewski et al., 2016).

### **Discussion and Conclusions**

This study investigated existing SRL instruments and aspects, finding that both SRL assessment and support instruments have been implemented in SRL studies, covering a wide range of different phases, as well as different targets for regulation. Different cognitive aspects of student learning are covered by both SRL assessment and support instruments. In practice, the use of SRL support instruments often follows the cyclical structure of different SRL phases. This type of instrument implementation, particularly when used to support SRL, is in agreement with empirical findings showing that students who successfully regulate their learning invest effort in each phase of the SRL cycle (Winne & Hadwin, 2008; Zimmerman, 2002). However, this study did not focus on analysing the effects of the different instrument uses, and it remains to be determined if these instruments actually promote these activities.

In addition to cognitive aspects, motivation and emotion also play important roles in SRL (Boekaerts & Pekrun, 2015; Zimmerman, 2002) and influence executive cognitive functions, metacognitive processes, and learning results (Boekaerts & Pekrun, 2015; Pintrich & De Groot, 1990). For instance, students' self-efficacy beliefs can influence their will to engage in cognitive functions and, thus, contribute to their learning achievements (Pintrich & De Groot, 1990).

Emotions also have different effects on student learning. Positive emotions can promote flexible and creative problem solving, whereas negative emotions promote more rigid, detail-oriented, and analytical ways of thinking (Boekaerts & Pekrun, 2015). Despite this knowledge, the results of this study indicate that motivational and emotional learning aspects are particularly lacking in the instruments designed to support elementary school students' SRL. On the one hand, this finding is

in line with the previous empirical evidence showing that younger elementary school students benefit from cognitive SRL supports in particular (Dignath & Büttner, 2008; Hattie et al., 1996), indicating the need to provide dedicated support to these processes. On the other hand, researchers have also emphasised the role of students' motivation and emotions during the first years of elementary school (Järvenoja et al., 2019; Perry, 1998). It will be up to future research to ask whether the benefits of motivation and emotional supports would become more visible if these supports were provided and researched more fully. To conclude, this study suggests that continuous development and research of SRL support instruments is needed to make them even more suitable and effective, especially for younger students' motivation and emotion regulation.

Previous studies have also shown the importance of feedback for students' SRL skill development (Butler & Winne, 1995; Randi & Corno, 2000), yet most of the SRL instruments identified in this study did not use feedback to support SRL development. This is an understandable finding for the SRL assessment instruments, which assess general aptitudes or SRL tendencies (Pintrich et al., 2000). Only about half of the SRL support instruments provided student feedback, even though their main purpose was to support students' SRL use. One explanation for this finding could be that the teachers' feedback given in supportive SRL classroom activities has not been previously reported. However, this finding does not explain why more than half of the technology-based SRL instruments do not systematically use personal feedback to support SRL development, especially in situations where teachers' roles were reduced. Personalised feedback to help students recognise their SRL behaviours is needed and important for younger students, whose ability to understand their own learning is not as developed as in older students (Perry & VandeKamp, 2000; Winne, 1997).

Prior research indicates that diverse ways of supporting students' SRL skills in different SRL phases (Zimmerman, 2002) could be included in SRL support teaching and learning designs, starting in the early school stages (Perry, 1998; Perry & VandeKamp, 2000). This study showed

that SRL phases were not clearly differentiated in most of the instruments, and when identifiable, this differentiation was targeted at cognitive functions. However, it should be noted that each instrument included in this overview had its own theoretical underpinnings, starting points and goals, and that they were not necessarily designed to cover all the targets or phases of SRL in the first place. The results of this study suggest that in the field of SRL research, more could be done to measure students' cognitive, motivational, and emotional SRL skills in different phases of the regulated learning cycle. This would give more targeted information about students' overarching SRL skills and provide more comprehensive evidence as to what type of support would benefit learners at different ages. Later on, this information would be beneficial for educational practices by providing evidence for how different targets of SRL can be supported in practice.

A limitation of this study is that it included only full-text articles. However, over 90% of the articles were reviewed, and they gave a wide overview of existing SRL instruments. Another limitation was that it used only two databases. Even though they were the two largest and most widely used databases, consideration of others could have resulted in the inclusion of additional material. Finally, it should be emphasised that this study did not analyse the effects or influence of SRL instrument use; hence, the results do not reveal whether or how effective the instruments were in assessing or supporting SRL.

This study combined the different types of SRL instruments and highlighted differences between them at the elementary school level. In general, SRL assessment instruments collect important information about students' behaviour and learning skills (Panadero, Klug, & Järvelä, 2016; Winne & Perry, 2000), whereas SRL support instruments can be used to create supportive SRL learning environments (Paris & Paris, 2001). Because this study did not analyse the effects of the various SRL instruments; there is a need for future research to conduct a systematic meta-analysis on the effects of different SRL supports for students' learning. Moreover, there is still work to be done regarding implementing the different SRL instruments in systematic and continuous

ways to enable the best possible support for teachers' work and students' SRL skill development. Ideally, combining understanding from the use of different instruments would ultimately allow for individualised feedback to help students self-regulate their present and future learning experiences.

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[Appendix 1 Near here]

[Appendix 2 Near here]

Table 1

*Frequencies of Different Targets and phases in Self-regulated Learning Models*

Targets/ Phases	Forethought	Performance	Reflection	All phases	Performance and reflection	Forethought and reflection	Not defined
Cognition	2	6	5	26	1	4	56
Motivation	3	5	2	11	1	3	79
Emotion	0	1	1	3	0	1	12

**Appendix 1. Identified SRL instrument and different aspects of them**

SRL assessment instruments		Codings			
Instrument	Publication/s where mentioned	SRL targets	SRL phases	Feedback	User
The Learning subscale of the Learning and Performance Orientations Questionnaire	Bouffard, T., Vzeau, C., & Bordeleau, L. (1998).	Motivation	Not recognized	No Feedback	Student
Self-regulation Questionnaire (SRQ)	Bouffard, T., Vzeau, C., & Bordeleau, L. (1998).	Cognition Motivation	Not recognized	No Feedback	Student

Behavioral engagement scale	Galla, B. M., Wood, J. J., Tsukayama, E., Har, K., Chiu, A. W., Langer, D. A. (2014).	Motivation	Not recognized	No Feedback	Teacher
Self-efficacy scale for children (SESC)	Galla, B. M., Wood, J. J., Tsukayama, E., Har, K., Chiu, A. W., Langer, D. A. (2014).  Totan, T. (2014).	Motivation	Not recognized	No Feedback	Student
Self-efficacy beliefs in self-regulated learning (SESRL scale)	Zuffianó, A., Alessandri, G., Gerbino, M., Luengo Kanacri, B. P., Di Giunta, L., Milioni, M., & Gaprara, G. V., (2013).	Motivation	Forethought	No Feedback	Student
Achievement Goal Questionnaire	Liem, G. A. D. (2016).	Cognition Motivation	Not recognized	No Feedback	Student
Motivated Strategies for Learning Questionnaire (MSLQ)	Sachs, J., Law, Y., & Chan, C. (2002).  Kaya, S., & Kablan, Z. (2013).  Middleton, M., & Midglaey, C. (1997).  Andrzejewski, C., Davis, H., Shalter Bruening, P., & Poirier, R. (2016).  Metallidou, P., & Vlachou, A. (2010).  Neber, H., He, J., Liu, B., & Schofield, N. (2008).  Yin, H., Lee, J., & Zhang, Z. (2009).  Ziegler, N. A. (2014).  Kim, C., Park, S., Cozart, J., & Lee, H. (2015).  Andriessen, I., Phalet, K., Lens, W. (2006).  Salili, F., & Lai, M. (2003).  Van Grinsven, L., & Tillema, H. (2006).  Sha, L., Looi, C., Chen, W., Seow, P., & Wong, L. (2012).	Cognition  Motivation	Not recognized	No Feedback	Student

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Kadioglu, C., & Uzuntiryaki Kondakci, E. (2014).

Schuitema, J., Peetsma, T., & Van der Veen, I. (2012).

Ng, B., Wang, C., & Liu, W. (2017).

Tsai, C., Lin, S., & Yuan, S. (2001).

Al-Rawahi, N., & Al-Balushi, S. (2015).

Rotgans, J., & Schmidt, H. (2010).

Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009).

Jacobse, A. E., & Harskamp, E. G. (2012).

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Learning Process Questionnaire (LPQ)

Sachs, J., Law, Y., & Chan, C. (2002).

Cognition  
Motivation

Not  
recognized

No  
Feedback

Student

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Patterns of Adaptive Learning Survey (PALS)	Middleton, M., & Midglaey, C. (1997).  Hole, J., Crozier, W. (2007). Peklaj, C., Podlesek, A., & Pecjak, S. (2015).  Salili, F., & Lai, M. (2003).	Motivation	Not recognized	No Feedback	Student
Self-regulated learning questionnaire	Middleton, M., & Midglaey, C. (1997).	Cognition	Not recognized	No Feedback	Student
Avoidance of help-seeking items	Middleton, M., & Midglaey, C. (1997).	Motivation	Not recognized	No Feedback	Student
Learning strategies questionnaire	Neber, H., He, J., Liu, B., & Schofield, N. (2008).	Cognition	Not recognized	No Feedback	Student
Goal Orientations questionnaire	Neber, H., He, J., Liu, B., & Schofield, N. (2008).	Motivation	Not recognized	No Feedback	Student
Big Five Inventory (BFI)	Luo, W., Hughes, J., Liew, J., & Kwok, O. (2009).	Motivation	Not recognized	No Feedback	Teacher
Social Competence scale	Luo, W., Hughes, J., Liew, J., & Kwok, O. (2009).	Motivation	Not recognized	No Feedback	Teacher
Cognitive competence scale of the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA)	Luo, W., Hughes, J., Liew, J., & Kwok, O. (2009).	Motivation	Not recognized	No Feedback	Student
Childrens mastery goal orientation, Puzzle Task	Luo, W., Hughes, J., Liew, J., & Kwok, O. (2009).	Motivation	Not recognized	No Feedback	Student
Rating Student Self-Regulated Learning Outcomes: A Teacher scale (RSSRL)	DiBenedetto, M. K., & Zimmerman, B. J. (2013).	Cognition	Not recognized	No Feedback	Teacher
		Motivation			
Microanalytic processes measure of self-regulated learning	DiBenedetto, M. K., & Zimmerman, B. J. (2013).	Cognition	Forethought	No Feedback	Student
		Motivation	Performance		
		Emotion	Reflection		
Metacognitive Self-Regulation (MRS)	Berger, J., & Karabenick, S. (2016).	Cognition	Not recognized	No Feedback	Student



SRL Questionnaire	Chang, C., Tseng, K., Liang, C., & Liao, Y. (2013).	Cognition Motivation Emotion	Not recognized	No Feedback	Student
Self-efficacy scale	Kitsantas, A., Robert, A., Doster, J. (2004).	Motivation	Not recognized	No Feedback	Student
Satisfaction with performance	Kitsantas, A., Robert, A., Doster, J. (2004).	Cognition	Reflection	No Feedback	Student
Evaluation of instruction	Kitsantas, A., Robert, A., Doster, J. (2004).	Cognition	Forethought Reflection	No Feedback	Student
Attributions of success or failure	Kitsantas, A., Robert, A., Doster, J. (2004).	Cognition Motivation	Not recognized	No Feedback	Student
Learning process inventory (LPI)	Wang, T. (2011).	Cognition Motivation	Forethought Reflection	No Feedback	Student
Students' adaptive learning engagement in science questionnaire (SALES)	Velayutham, S., Aldridge, J., & Fraser, B. (2011). Bedford, S. (2017).	Motivation	Not recognized	No Feedback	Student
Emotion and Motivation Self-regulation Questionnaire (EMSR-Q)	Alonso-Tapia, J., Panadero, E., & Díaz Ruiz M. (2014). Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Motivation Emotion	Not recognized	No Feedback	Student
Motives and expectancies questionnaire (MEVA3)	Alonso-Tapia, J., Panadero, E., & Díaz Ruiz M. (2014).	Motivation	Not recognized	No Feedback	Student
The Classroom Motivation Climate Questionnaire (CMCQ)	Alonso-Tapia, J., Panadero, E., & Díaz Ruiz M. (2014).	Motivation	Not recognized	No Feedback	Student
Metaconceptual Awareness and Regulation Scale (MARS)	Kirbulut, Z., Uzuntiryaki-Kondakci, E., & Beeth, M. (2016).	Cognition	Not recognized	No Feedback	Student
Self-efficacy and Metacognitive Learning Inventory-Science (SEMLI-S)	Thomas, G., Anderson, D., & Nashon, S. (2008).	Cognition Motivation	Not recognized	No Feedback	Student

Self-Regulatory Strategies Scale (SRSS)	Kadioglu ,C., Uzuntiryaki, E., & Aydin,Y. (2011).	Cognition Motivation	Not recognized	No Feedback	Student
Patterns of adaptive learning survey (PALS)	Hole, J., & Cronzier, W. (2007).	Motivation	Not recognized	No Feedback	Student
Puzzles	Hole, J., & Cronzier, W. (2007).	Motivation	Not recognized	No Feedback	Student
TAP measures (Think aloud protocol)	Greene, J., Bolick, C., Jackson,W., Caprino, A., Oswald,C., & McVea, M. (2015).	Cognition Motivation Emotion	Forethought Performance Reflection	No Feedback	Student
Questionnaire for the students	Smit, R., Bachmann, P., Blum, V., Birri, T., & Hess, K. (2017).	Cognition Motivation	Not recognized	No Feedback	Student
Questionnaire for the teachers	Smit, R., Bachmann, P., Blum, V., Birri, T., & Hess, K. (2017).	Cognition	Not recognized	No Feedback	Teacher
General and Spesific Self-Regulation Questionnaire (GSSRQ)	Alonso-Tapia, J., & Panadero, E. (2010).	Cognition Motivation	Not recognized	No Feedback	Student
On-Line Self-Regulation Index (OLSRI)	Alonso-Tapia, J., & Panadero, E. (2010).	Cognitio Motivation Emotion	Forethought Performance Reflection	No Feedback	Student
Self-efficacy Measure	Alonso-Tapia, J., & Panadero, E. (2010).	Motivation	Not recognized	No Feedback	Student
Meva	Alonso-Tapia, J., & Panadero, E. (2010). Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Motivation	Not recognized	No Feedback	Student
Attitude Toward Mathematics Survey	Miller, R., Greene, B., Montalvo, G., Ravindran, B., & Nichols, J. (1996).	Cognition Motivation	Not recognized	No Feedback	Student
self-assessment measure	Long, Y., & Aleven, V. (2017).	Motivation	Forethought	No Feedback	Student
ESCOLA	Jiménez-Rodríguez, V., Ulate-Espinoza, M., Alvarado-Izquierdo, J., & Puente-Ferreras, A., (2015).	Cognition	Not recognized	No Feedback	Student
Classroom Motivation Climate (CMC-Q questionnaire)	Jiménez-Rodríguez, V., Ulate-Espinoza, M., Alvarado-Izquierdo, J., & Puente-Ferreras, A., (2015).	Motivation	Not recognized	No Feedback	Student
How Will I Do? (HWD)	Cirino, P., Miciak, J., Gerst, E., Barnes, M., Vaughn, S., Child, A., & Huston-Warren, E. (2017).	Cognition Motivation	Forethought	No Feedback	Student

How Did I Do? (HDD)	Cirino, P., Miciak, J., Gerst, E., Barnes, M., Vaughn, S., Child, A., & Huston-Warren, E. (2017).	Cognition Motivation	Reflection	No Feedback	Student
Student Learning Questionnaire (SLQ)	Cirino, P., Miciak, J., Gerst, E., Barnes, M., Vaughn, S., Child, A., & Huston-Warren, E. (2017).	Cognition Motivation	Forethought Reflection	No Feedback	Student
SRLvoc	Ziegler, N. (2014).	Cognition Motivation Emotion	Not recognized	No Feedback	Student
Questionnaire	Hessels-Schlatter, C., Hessels, M., Godin, H., & Spillmann-Rojas, H. (2017).	Cognition	Not recognized	No Feedback	Student
Achievement Emotion Questionnaire in Mathematics (AEQ-M)	Kim, C., Park, S., Cozart, J., & Lee, H. (2015).	Emotion	Not recognized	No Feedback	Student
RASI	Andriessen, I., Phalet, K., & Lens, W. (2006).	Cognition	Not recognized	No Feedback	Student
Motivational strategies scale	Peklaj, C., Podlesek, A., & Pecjak, S. (2015).	Motivation	Not recognized	No Feedback	Student
Questionnaire about Learning in Mathematics (QLM)	Peklaj, C., Podlesek, A., & Pecjak, S. (2015).	Motivation	Not recognized	No Feedback	Student
Mindset Assessment Profile (MAP)	Bedford, S. (2017).	Motivation	Not recognized	No Feedback	Student
SRL Questionnaire	Kramarski, B., & Gutman, M. (2006).	Cognition	Not recognized	No Feedback	Student
Multidimensional Scales of Perceived Self-efficacy (MSPSE)	Escarti, A., Gutiérrez, M., Pascual, C., & Llopis Going, R. (2010).	Motivation	Not recognized	No Feedback	Student
Student Learning Strategies Questionnaire (SLSQ)	Meyer, E., Abrami, P., Wade, C., Aslan, O., & Deault, L. (2010).	Cognition	Not recognized	No Feedback	Student
Self-Regulated Learning Questionnaire (SRLQ)	Swalander, L., & Taube, K. (2007). Michalsky, T. (2013).	Cognition Motivation	Not recognized	No Feedback	Student
Reading behavior inventory (derived from the Metacognitive Awareness of Reading Strategy Inventory)	Lau, K. (2012).	Cognition	Not recognized	No Feedback	Student

Motivation to Read Questionnaire (MRQ)	Lau, K. (2012). Cantrell, S., Almasi, J., Rintamaa, M., Carter, J., Pennington, J., & Buckman, D. (2014). Law, Y. (2009).	Motivation	Not recognized	No Feedback	Student
Strategy related task performance	Schünemann, N., Spörer, N., & Brunstein, J. (2013).	Cognition	Not recognized	No Feedback	Teacher
Self-efficacy for Reading	Schünemann, N., Spörer, N., & Brunstein, J. (2013).	Motivation	Not recognized	No Feedback	Student
Measures of Goal Orientation and General Self- efficacy (based on the Pattern of Adaptive Learning Survey (PALS))	Salili, F., & Lai, M. (2003).	Motivation	Not recognized	No Feedback	Student
Self-efficacy in Learning English	Salili, F., & Lai, M. (2003).	Motivation Emotion	Not recognized	No Feedback	Student
Student Motivation to Learn Science (SMLS)	Schulze, S., & van Heerden, M. (2015).	Motivation	Not recognized	No Feedback	Student
Scales for the Assessment of Learning and Performance Motivation School-Student Version, (SELLMO)	Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012).	Motivation	Not recognized	No Feedback	Student
Questionnaire contained scales on self-estimations of scholastic interest, learning goal orientation, self- efficacy, monitoring/assessment of learning	Lüftenegger, M., Schober, B., van de Schoot, R., Wagner, P., Finsterwald, M., & Spiel, C. (2012).	Cognition Motivation	Not recognized	No Feedback	Student
Self-Regulation Questionnaire (SRQ)	Wang, H., Chen, H., Lin, H., Huang, Y., & Hong, Z. (2017).	Cognition	Not recognized	No Feedback	Student

LASSI	Eilam, B., & Reiter, S. (2014).	Cognition Motivation Emotion	Not recognized	No Feedback	Student
YSRI	Eilam, B., & Reiter, S. (2014).	Cognition	Performance	No Feedback	Student
WSRI	Eilam, B., & Reiter, S. (2014).	Cognition Motivation	Forethought Performance	No Feedback	Student
TSRI	Eilam, B., & Reiter, S. (2014).	Cognition	Reflection	No Feedback	Student
ESCOLA	Jiménez, V., Puente, A., Alvarado, J., & Arbillaga, L. (2009).	Cognition Motivation	Not recognized	No Feedback	Student
Metacognitive Awareness of Reading Strategies Inventory (MARS)	Jiménez, V., Puente, A., Alvarado, J., & Arbillaga, L. (2009).  Cantrell, S., Almasi, J., Rintamaa, M., Carter, J., Pennington, J., & Buckman, D. (2014).  Law, Y. (2009).	Cognition	Not recognized	No Feedback	Student
Self-regulatory inventory (subscales of planning and effort)	Toering, T., Elferink-Gemser, M., Jonker, L., van Heuvelen, M., & Visscher, C. (2012).	Cognition Motivation	Not recognized	No Feedback	Student
Self-Regulation Trait Questionnaire	Toering, T., Elferink-Gemser, M., Jonker, L., van Heuvelen, M., & Visscher, C. (2012).	Cognition	Not recognized	No Feedback	Student
Self-efficacy scale	Toering, T., Elferink-Gemser, M., Jonker, L., van Heuvelen, M., & Visscher, C. (2012).	Motivation	Not recognized	No Feedback	Student
Inventory of Metacognitive Self-Regulation	Toering, T., Elferink-Gemser, M., Jonker, L., van Heuvelen, M., & Visscher, C. (2012).	Cognition	Not recognized	No Feedback	Student
Reflective continuum	Toering, T., Elferink-Gemser, M., Jonker, L., van Heuvelen, M., & Visscher, C. (2012).	Motivation	Not recognized	No Feedback	Student

SRClang scale	Liu, H., & Lee, Y. (2015).	Cognition Motivation Emotion	Not recognized	No Feedback	Student
Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI)	Vandevelde, S., Van Keer, H., & Rosseel, Y. (2013).	Cognition Motivation	Not recognized	No Feedback	Student
Text Learning Strategy Inventory (TLSI)	Merchie, E., & Van Keer, H. (2016).	Cognition	Not recognized	No Feedback	Student
Self-Regulated Learning Strategies Assessment (S-RLSA)	Chen, S. (2017).	Cognition	Not recognized	No Feedback	Student
Reading Instruction Inventory	Lau, K., & Chen, X. (2013).	Cognition	Not recognized	No Feedback	Student
Reading strategy inventory	Lau, K., & Chen, X. (2013).	Cognition	Not recognized	No Feedback	Student
Reading Motivation Questionnaire	Lau, K., & Chen, X. (2013).	Motivation	Not recognized	No Feedback	Student
MT Cognitive Processes Questionnaire (MTCQP)	Fritz, B., & Peklaj, C. (2011).	Cognition	Not recognized	No Feedback	Student
MT Affective-motivational Processes Questionnaire (MTAMPQ)	Fritz, B., & Peklaj, C. (2011).	Motivation	Not recognized	No Feedback	Student
Goal Orientation Scale	Kadioglu, C., & Uzuntiryaki Kondakci, E. (2014).	Motivation	Not recognized	No Feedback	Student
Self-efficacy questionnaire	Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Motivation	Performance Reflection	No Feedback	Student
On-line self-regulation index	Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Cognition Emotion	Performance	No Feedback	Student
Standardized diaries as a self-monitoring tool	Schmitz, B., & Perels, F. (2011).	Cognition Motivation Emotion	Forethought Reflection	No Feedback	Student

Self-Regulation Questionnaire	Schmitz, B., & Perels, F. (2011).	Cognition Motivation	Not recognized	No Feedback	Student
SR questionnaire	Chen, L., & Sun, C. (2016).	Motivation Emotion	Reflection	No Feedback	Student
Self-Regulation Strategy Inventory-Self-Report (SRSI-SR)	Cleary, T., & Chen, P. (2009) Cleary, T. (2006)	Cognition Motivation	Performance	No Feedback	Student
Task Interest Inventory (TII)	Cleary, T., & Chen, P. (2009).  Cleary, T. (2006).	Motivation	Performance	No Feedback	Student
Perceived Instrumentality Inventory (PII)	Cleary, T., & Chen, P. (2009).  Cleary, T. (2006).	Motivation	Performance	No Feedback	Student
Self-standards measure	Cleary, T., & Chen, P. (2009).	Motivation	Performance	No Feedback	Student
Self-efficacy for self-regulated learning scale	Adams, C., Forsyth, P., Dollarhide, E., Miskell, R., & Ware, J. (2015).	Cognition Motivation	Not recognized	No Feedback	Student
Self-efficacy measure	Joët, G., Usher, E., & Bressoux, P. (2011).	Motivation	Not recognized	No Feedback	Student
Self-efficacy for self-regulated learning scale	Joët, G., Usher, E., & Bressoux, P. (2011).	Motivation	Not recognized	No Feedback	Student
Sources of self-efficacy	Joët, G., Usher, E., & Bressoux, P. (2011).	Motivation	Not recognized	No Feedback	Student
Self-efficacy scale for children (SESC)	Totan, T. (2014).	Motivation Emotion	Not recognized	No Feedback	Student
Meta-Affective Trait Scale (MATS)	Uzuntiryaki-Kondakci, E., & Kirbulut, Z. (2016).	Emotion	Not recognized	No Feedback	Student
Regulation and orientation scales of the inventory of learning styles (ILS)	Helle, L., Laakkonen, E., Tuijula, T., & Vermunt, J. (2013).	Cognition Motivation	Not recognized	No Feedback	Student

Difficulties in Emotion Regulation Scale (DERS)	Metz, S., Frank, J., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. (2013).	Emotion	Not recognized	No Feedback	Student
Affective Self-Regulatory Efficacy Scale (ASRES)	Metz, S., Frank, J., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. (2013).	Motivation Emotion	Not recognized	No Feedback	Student
Learning process Questionnaire	García, F., García, A., Berbén, A., Pichardo, M., & Justicia, F. (2014).	Cognition Motivation	Not recognized	No Feedback	Student
Strategic self-regulation (SPOCK)	García, F., García, A., Berbén, A., Pichardo, M., & Justicia, F. (2014).	Cognition	Not recognized	No Feedback	Student
Metacognitive knowledge (Junior Metacognitive Awareness Inventory (Jr. MAI)	García, F., García, A., Berbén, A., Pichardo, M., & Justicia, F. (2014). Sperling, R., Richmond, A., Ramsay, C., & Klapp, M. (2012).	Cognition	Not recognized	No Feedback	Student
Metacognitive Awareness of Reading Strategies Inventory (MARS)	Cantrell, S., Almasi, J., Rintamaa, M., Carter, J., Pennington, J., & Buckman, D. (2014).	Cognition	Performance	No Feedback	Student
Swanson Metacognitive Questionnaire (SMQ)	Sperling, R., Richmond, A., Ramsay, C., & Klapp, M. (2012).	Cognition	Not recognized	No Feedback	Student
Student Assessment for Learning Questionnaire (SAFL)	Baas, D., Castelijn, J., Vermeulen, M., Martens, R., & Segers, M. (2015).	Cognition	Not recognized	No Feedback	Student
Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI)	Baas, D., Castelijn, J., Vermeulen, M., Martens, R., & Segers, M. (2015).	Cognition	Not recognized	No Feedback	Student
Wolters (Motivation regulation strategies questionnaire (MRS))	Wolters, C. (1999).	Cognition Motivation	Not recognized	No Feedback	Student
Self-efficacy	Obergruesser, S., & Stoeger, H. (2015).	Motivation	Not recognized	No Feedback	Student
Learning goal orientation (base on Manual for the Patterns of Adaptive Learning Scale)	Obergruesser, S., & Stoeger, H. (2015).	Motivation	Not recognized	No Feedback	Student
Children's Perceived Self-Efficacy scales (CPSE)	Pastorelli, C., Caprara, G., Barbaranelli, C., Rola, J., Rozsa, S., & Bandura, A. (2001).	Motivation	Not recognized	No Feedback	Student
Citizen science self-efficacy scale (CSSES)	Hiller, S., & Kitsantas, A. (2016).	Motivation	Not recognized	No Feedback	Student
Sources of self-efficacy scale	Hiller, S., & Kitsantas, A. (2016).	Motivation	Not recognized	No Feedback	Student



Task Interest scale	Hiller, S., & Kitsantas, A. (2016).	Motivation	Not recognized	No Feedback	Student
Citizen science outcome expectations scale	Hiller, S., & Kitsantas, A. (2016).	Motivation	Not recognized	No Feedback	Student
Mental effort rating scale	Kostons, D., van Gog, T., & Paas, F. (2012).	Motivation	Performance	No Feedback	Student
A CA questionnaire	Zhang, W. (2017).	Motivation	Not recognized	No Feedback	Student
SRL questionnaire	Zhang, W. (2017).	Cognition Motivation	Not recognized	No Feedback	Student
Questionnaire of English Self-Efficacy (QESE)	Wang, C., & Bai, B. (2017).	Motivation	Not recognized	No Feedback	Student
Questionnaire of English Self-Regulated Learning Strategies (QESRLS)	Wang, C., & Bai, B. (2017).	Cognition Motivation	Not recognized	No Feedback	Student
Motivation and self-regulation towards technology learning instrument (MSRTL)	Liou, P., & Kuo, P. (2014).	Cognition Motivation	Not recognized	No Feedback	Student

#### **SRL support instruments**

<b>Instrument</b>	<b>Publication/s where mentioned</b>	<b>SRL targets</b>	<b>SRL phases</b>	<b>Feedback</b>	<b>User</b>
AR-SaBEr simulator	Ibanez, M., Di-Serio, A., Villaran-Molina,D., & Delgado-Kloos, C. (2015).	Cognition Motivation	Forethought Performance Reflection	No Feedback	Student
Classroom based strategy intervention	Andrzejewski, C., Davis, H., Shalter Bruening,P., & Poirier,R. (2016).	Cognition Motivation	Not recognized	Feedback	Student
Self-monitoring forms	Andrzejewski, C., Davis, H., Shalter Bruening,P., & Poirier,R. (2016).	Cognition Motivation	Forethought Performance Reflection	No Feedback	Student

Web-based portfolio assessment system (WBPAS)	Chang, C., Tseng, K., Liang, C., & Liao, Y. (2013).	Cognition	Forethought Performance Reflection	Feedback	Student
Young Scientist	Pedaste, M., & Sarapuu, T. (2014).	Cognition	Forethought Performance Reflection	Feedback	Student
Different SRL supportive classroom practices	Kitsantas, A., Robert, A., Doster, J. (2004).	Cognition	Forethought Performance Reflection	No Feedback	Student
Peer-Driven Assessment Module of the Web-based Assessment and Test Analysis system (PDA-WATA)	Wang, T. (2011).	Cognition Motivation	Not recognized	Feedback	Student
Strategy focussed training session	Torrance, M., Fidalgo, R., & Robledo, P. (2015).	Cognition	Forethought Performance Reflection	Feedback	Student
Lynette platform	Long, Y., & Aleven, V. (2017).	Cognition	Forethought Performance Reflection	Feedback	Student
SRL supportive classroom practices	Zamora, Á., Suárez, J., & Ardura, D. (2018).	Cognition	Forethought Performance Reflection	Feedback	Student
Planning template	Fletcher, A. (2016).	Cognition	Forethought Performance Reflection	No Feedback	Student
SRL supportive classroom practices	Cirino, P., Miciak, J., Gerst, E., Barnes, M., Vaughn, S., Child, A., & Huston-Warren, E. (2017).	Cognition Motivation	Forethought Performance Reflection	No Feedback	Student
Digital Reading Annotation System (DRAS system)	Chen, C., Wang, J., & Chen, Y. (2013).	Cognition Motivation	Forethought Performance Reflection	No Feedback	Student
IMPROVE method	Kramarski, B., & Gutman, M. (2006).	Cognition	Forethought	Feedback	Student

			Performance		
	Michalsky, T. (2013).		Reflection		
ePEARL	Meyer, E., Abrami, P., Wade, C., Aslan, O., & Deault, L. (2010).	Cognition	Forethought	Feedback	Student
		Motivation	Performance		
			Reflection		
Geometry Cognitive Tutor	Roll, I., Aleven, V., McLaren, B., & Koedinger, K. (2011).	Cognition	Forethought	Feedback	Student
			Performance		
			Reflection		
Self-Regulated Strategy Development (SRSD)	Zumbrunn, S., & Bruning, R. (2013).	Cognition	Forethought	Feedback	Student
	Festas, I., Oliveira, A., Rebelo, J., Damião, M., Harris, K., & Graham, S. (2015).		Performance		
	Hacker, D., Dole, J., Ferguson, M., Adamson, S., Roundy, L., Scarpulla, L. (2015)		Reflection		
	Washburn, E., Sielaff, C., & Golden, K. (2016)				
	Wong, B., Hoskyn, M., Jai, D., Ellis, P., & Watson, K. (2008).				
SRL supportive classroom practices	Schünemann, N., Spörer, N., & Brunstein, J. (2013).	Cognition	Forethought	Feedback	Student
			Performance		
			Reflection		
SRL supportive classroom practices	Eilam, B., & Reiter, S. (2014).	Cognition	Forethought	No Feedback	Student
		Motivation	Performance		
			Reflection		

Mind map strategy instruction	Merchie, E., & Van Keer, H. (2016).	Cognition	Forethought Performance Reflection	No Feedback	Student
SRL supportive classroom practices (Rubric)	Andrade, H., & Boulay, B. (2003).	Cognition	Performance Reflection	Feedback	Student
Rubric	Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Cognition	Performance Reflection	Feedback	Student
Script	Panadero, E., Alonso-Tapia, J., & Huertas, J. (2012).	Cognition	Performance Reflection	Feedback	Student
Bettys' Brain	Roscoe, R., Segedy, J., Sulcer, B., Jeong, H., & Biswas, G. (2013).	Cognition	Performance Reflection	Feedback	Student
Self-evaluation form	Kaya, B., & Ates, S. (2016).	Cognition	Forethought Performance Reflection	No Feedback	Student
Learning to BREATH programme	Metz, S., Frank, J., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. (2013).	Emotion	Not recognized	No Feedback	Student
SRL supportive classroom practices	García, F., García, A., Berbén, A., Pichardo, M., & Justicia, F. (2014).	Cognition	Forethought Performance Reflection	No Feedback	Student
CSRI programme	Torrance, M., Fidalgo, R., & Garcia, J. (2007).	Cognition	Forethought Performance Reflection	Feedback	Student
Visualization and accuracy (VisA instrument)	Jacobse, A. E., & Harskamp, E. G. (2012).	Cognition	Forethought Performance Reflection	No Feedback	Student
SRL supportive classroom practices	Hübner, S., Nückles, M., & Renkl, A. (2010).	Cognition	Reflection	No Feedback	Student
Writing Learning Journals (introduction lesson, why it is a opportunity for learning learning strategies)	Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012).	Cognition	Forethought	No Feedback	Student

## Appendix 2. Reference list of the all analysed articles, which fulfilled the used selection criterias.

- Adams, C. M., Forsyth, P. B., Dollarhide, E., Miskell, R., & Ware, J. (2015). Self-regulatory climate: A social resource for student regulation and achievement. *Teachers College Record, 117*(2), 1-28.
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- Alonso-Tapia, J., & Panadero, E. (2010). Effects of self-assessment scripts on self-regulation and learning. *Infancia Y Aprendizaje, 33*(3), 385-397.
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- Baas, D., Castelijn, J., Vermeulen, M., Marters, R., & Segers, M. (2015). The relation between assessment for learning and elementary students' cognitive and metacognitive strategy use. *British Journal of Educational Psychology*, 85(1), 33-46.
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- Chen, C., Wang, J., & Chen, Y. (2013). Facilitating english-language reading performance by a digital reading annotation system with self-regulated learning mechanisms. *Educational Technology and Society*, 17(1), 102-114.
- Chen, L., & Sun, C. (2016). Self-regulation influence on game play flow state. *Computers in Human Behavior*, 54, 341-350.

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- Cirino, P. T., Miciak, J., Gerst, E., Barnes, M. A., Vaughn, S., Child, A., & Huston-Warren, E. (2017). Executive function, self-regulated learning, and reading comprehension: A training study. *Journal of Learning Disabilities, 50*(4), 450-467.
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