

Reviewing findings on socially shared regulation of learning

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Abstract

Socially shared regulation of learning (SSRL) has been recognized as a new and growing field in the framework of self-regulated learning theory in the past decade. In the present review we examined the empirical evidence to support such a phenomenon. A total of 17 articles addressing SSRL were identified, 13 of which presented empirical evidence. Through a narrative review it could be concluded that there is enough data to maintain the existence of SSRL in comparison to other social regulation (e.g. co-regulation). It was found that most of the SSRL research has focused on characterizing phenomena through the use of mixed methods through qualitative data, mostly video-recorded observation data. Also, SSRL seems to contribute to students' performance. Finally, the article discusses the need for the field to move forward, exploring the best conditions to promote SSRL, clarifying whether SSRL is always the optimal form of collaboration and identifying more aspects of groups' characteristics.

Keywords: socially shared regulated learning, shared regulation, self-regulated learning, collaborative learning, CSCL.

Reviewing findings on socially shared regulation of learning

1. Introduction

How students regulate their own learning through the use of strategies has been one of the most important topics in educational psychology for the past decades. These studies started receiving considerable attention after Flavell (1979) introduced the metacognition theory, and this attention continued when self-regulation theories started to develop (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 2011). Currently there is a strong consensus that successful learners use a repertoire of strategies – cognitive, behavioural and motivational – to guide and enhance their learning processes while completing academic tasks (Schunk & Zimmerman, 2008). The mainstream of research on self-regulation has focused on individual learning situations, but the notion that social context is important in students' self-regulated learning is evidenced in a wide range of SRL research, and research into social aspects of SRL has increased considerably in recent years (Hadwin, Järvelä, & Miller, 2011).

Grounded in Zimmerman's (1989) social cognitive model of self-regulation, research has been guided by the principles that social context and environment play a reciprocal role in *self-regulated learning* (SRL), which is embedded in social context and influence. SRL research is also framed by sociocultural explanations (e.g. Vygotsky, 1978) that social interactions with more capable others facilitate students' development of SRL through internalizing the modelled cognitive processes. The premise of this research is that SRL is an internal process, assisted and influenced by social interaction (e.g. Zimmerman, 1990). Thus, it means investigating social support as an independent variable on SRL and examining a wide variety of social supports, including modelling, scaffolding and other-regulation, such as support provided by peers, teachers and parents (McCaslin & Hickey, 2001; Paris & Paris, 2001).

The term *co-regulated learning* is grounded in Vygotskian views of higher psychological processes being socially embedded or contextualized (Vygotsky, 1978) and Wertsch and Stone's

(1985) notion that these processes are internalized through social interaction (McCaslin, 2009). McCaslin and Hickey (2001) defined co-regulation as a manifestation of emergent interaction within a zone of proximal development, and Volet, Vauras, and Salonen (2009) grounded the concept of other-regulation in the Vygotskian (1978) notions of the Zone of Proximal Development and scaffold guidance from other-regulation to self-regulation.

Recently, the concept of *socially shared regulation of learning* (SSRL) has emerged, which occurs when groups regulate together as a collective, such as when they construct shared task perceptions or shared goals. When groups co-construct plans or align monitoring perceptions to establish a shared evaluation of progress, they are engaged in shared regulation (Järvelä, Järvenoja, Malmberg, & Hadwin, 2013). Therefore, SSRL refers to processes by which group members regulate their collective activity, which is different to co-regulation of learning, where individuals' regulatory activities are guided, supported or prompted by and with others, especially in computer supported collaborative learning contexts (Järvelä & Hadwin, 2013). SSRL involves interdependent or collectively shared regulatory processes, beliefs, and knowledge (e.g., strategies, monitoring, evaluation, goal setting, motivation, metacognitive decision making) orchestrated in the service of a co-constructed or shared outcome (Winne, Hadwin, & Perry, 2013). Interest in shared regulatory group processes has emerged since a change in pedagogical practices in current learning environments. Past decades have witnessed the success of collaborative learning, since it allows opportunities for shared knowledge construction and productive collaborative interactions (Dillenbourg, 1999; Roschelle & Teasley, 1995). Information and communication technologies as CSCL have fundamentally changed how people communicate, collaborate, work, play and learn – but have also brought new challenges for group coordination, argumentation and engagement (Järvelä, Volet, & Järvenoja, 2010). Hadwin, Järvelä, and Miller (2011) claim that regulated learning is the quintessential skill in collaborative learning. Working together means co-constructing shared

task representations, shared goals and shared strategies. It also means regulating learning through shared metacognitive monitoring and control of motivation, cognition and behaviour.

In sum, in the past decade there has been a shift in the field of research into the role that collaborative learning and CSCL environments imply for the regulation of learning (e.g. Järvelä et al., 2010; Vauras, Iiskala, Kajamies, Kinnunen, & Lehtinen, 2003). The focus in this research line is on how the groups regulate their collaborative work and how this affects their learning experience as a group entity. Currently, the concept of socially shared regulation is increasingly being used in educational psychology literature and its use is spreading to other related fields as well, e.g. computer-supported collaborative learning (Kirschner & Erkens, 2013). Compared to other regulatory concepts, such as SRL and co-regulation, the empirical evidence of regulatory processes in collaborative learning – this is to say, socially shared regulation of learning – is still minor and distributed. Our aim is to review all empirical research about the existence of socially shared regulation of learning to find confirmation that it is a real construct that can be found in collaborative learning situations. Even though the research is still limited, a review of current empirical evidence is needed to increase conceptual clarity and find rigorous evidence of the phenomena.

1.1. Related concepts in the field of social aspects of regulated learning

Concepts which are closely related to SSRL can be found in the research literature. Vauras and Volet (2013) use an umbrella concept of ‘interpersonal regulation’ to explain the functioning of groups as complex and dynamic situational interplays across different systemic levels (Volet, Vauras, et al., 2009), showing that the study of interpersonal regulation of learning is located at the articulation of individual and social processes (Järvelä et al., 2010). Most conceptualizations of interpersonal regulation of learning research have been inspired by Greeno’s (2006) situative learning framework which integrates the individual and social perspective in ‘learning in activity’ (Greeno, 2006, p. 92) and complements the interactional focus on participatory processes with a cognitive focus on

information processes. In those studies the concept of regulation has been used to describe the social processes the groups use to regulate their joint work on a task (Rogat & Linnenbrink-Garcia, 2011) or the nature and processes of collaborative interactions (Volet, Summers, & Thurman, 2009), and the conceptualization of regulation has been used as productive engagement in collaborative interactions.

Other fields of interest to regulation of learning derive from sociocultural learning theory and the Vygotskian perspective. Concepts such as co-regulation and other-regulation have been used to explain the transitional processes towards self-regulation. According to McCaslin and Hickey (2001), the social system that individuals are part of is assumed to provide affordances and constraints for members to fully engage, to stay at the periphery until ready or alternatively to avoid engagement. For example, Vauras and colleagues' studies on socially shared co-regulation (e.g. Salonen, Vauras, & Efklides, 2005; Vauras et al., 2003) point to the social context as the developmental source of self-regulation, and provide support for the contention that teacher scaffolding, involving an emphasis on collaborative learning and opportunities for co-regulation, provided an appropriate context for students to learn and deploy academic regulatory strategies.

The concept of metacognition is also related to the discussion of regulated learning. Dinsmore, Alexander, and Loughlin (2008) have discussed the clarity of meaning of metacognition, self-regulation and self-regulated learning that are often used in parallel, even though they are different phenomena. The three concepts involve individuals' monitoring and regulation of their learning, but the articulation of conceptual boundaries between these terms is overlapping. This is the case also when considering metacognition in social aspects of regulated learning.

Metacognition researchers have acknowledged the role of peers and more knowledgeable others in mediating and sharing metacognitive knowledge (Brown, 1987; Goos, Galbraith, & Renshaw, 2002). For example, Artz and Armour-Thomas (1992) examined the role of metacognition in small-group mathematical problem-solving by tracking individual students' cognitive and

metacognitive behaviours and concluded that successful group problem-solving requires the constant interplay of cognitive and metacognitive processes, and individuals competent enough to adapt the metacognitive statements to the process. Recently, researchers have described and operationalized metacognition at peer interaction or group level, and concepts such as socially shared metacognition (Hadwin, Oshige, Gress, & Winne, 2010; Hurme, Merenluoto, & Järvelä, 2009; Iiskala, Vauras, & Lehtinen, 2004) or socially shared metacognitive regulation (Iiskala, Vauras, Lehtinen, & Salonen, 2011) have emerged in reference to regulation of cognitive processes in interactive learning tasks. In these studies, the central idea has been that group members monitor and control each other's actions to advance the group's problem-solving.

1.2. Identified challenges in the field

In spite of increasing interest in SSRL, three identified challenges emerge in this research area. The first challenge is dealing with conceptual clarity issues. There seem to be considerable differences in how authors and research teams define and operationalize social aspects of self-regulated learning, such as self-regulation, co-regulation, other-regulation, high-level co-regulation, shared metacognition, self in social setting regulation and socially shared regulation, which have been applied in recent theoretical and empirical discussions, and there still seems to be a lack of congruence (e.g. Dinsmore et al., 2008).

Secondly, during the past few years, researchers involved in collaborative learning and CSCL research (Hmelo-Silver & Barrows, 2008; Kirschner & Erkens, 2013) and self-regulated learning research (Hadwin et al., 2011; Volet, Vauras, et al., 2009; Winne et al., 2013) have worked in parallel to investigate 'regulation of learning', which has resulted in concepts which partly overlap, but still have various conceptual and empirical foci. For example, collaborative learning research and computer-supported collaborative learning research has targeted the general level of regulation of social interactions and knowledge co-construction processes (Saab, 2012). Research on team learning

has introduced the concept of task regulation, with a focus on task and domain-specific regulation (Saab, van Joolingen, & van Hout-Wolters, 2012), and the concept of team regulation, focusing on social aspects of team formation (Fransen, Kirschner, & Erkens, 2011; Fransen, Weinberger, & Kirschner, 2013).

The third challenge deals with methodological development. Research methods, which consider the interplay between individual and social processes as they unfold in authentic activity, (Greeno, 2006) are still in their infancy. Even though there are new and promising methodological opportunities for studying interpersonal regulation (see Vauras & Volet, 2013), the lack of empirical findings may derive from inadequate methods, which focus either on individual regulatory activities or on social and collaborative interaction processes. For example, Järvelä and Hadwin (2013) have identified that current empirical research is obscure to differentiate shared regulation from shared knowledge construction, mostly because of a lack of methods and analytical techniques for examining individual and collaborative performance outcomes associated with interactional processes. These three challenges will be addressed through the empirical review conducted in this paper.

1.3. Aim and research questions

The aim of this review is to analyse the empirical evidence that supports the theoretical concept of socially shared regulation of learning (SSRL) including the related terms socially shared metacognition and co-regulation -when used with the purpose of distinguishing among qualitative different types of social regulation in collaborative learning-. Our research questions are:

- a) What are the main characteristics of SSRL?
- b) Can different levels of social regulation be identified (SSRL vs. co-regulation)?
- c) What is the relationship of SSRL and other studied learning variables?
- d) What are the salient features of SSRL research?

From those questions we will identify the following features of SSRL research: type of study, sample, subject or task, type of data, data analysis, procedure and main results. We will also consider the limitations of the current research and discuss where the field should move next.

2. Method

2.1. *Criteria for inclusion*

Studies from different disciplines were reviewed and included or rejected based on their relevance. First, a study was considered relevant for our research if it contained empirical data on the existence of socially shared regulation of learning or related concepts such as socially shared metacognition, shared regulation or high-level co-regulation. Articles with theoretical arguments were considered if they addressed crucial aspects for the development of the field and their conclusions were based on empirical research. Second, the selection was limited only to printed and peer-reviewed material, such as articles in journals, edited books, research reports and doctoral dissertations. Third, articles had to be written in English.

2.2. *Search keywords, databases and selection process*

A first literature search was conducted in October 2012 via the PsycINFO, ERIC and Thomson Reuters Web of Knowledge databases with no limitation on the year of publication. The following keywords were used: socially shared regulation (SSRL), socially shared metacognition (SSM), co-regulation, and social regulation. A total of 16 hits were found for SSSRL, 8 hits for SSM, 83 hits for co-regulation, and over 5000 for social regulation. All hits for SSRL and SSM were selected for further exploration, five of them being repeated hits. To obtain more specific scope hits, new searches were performed using co-regulation and social regulation adding the terms: educational psychology and educational research. This reduced the hits to 75 for co-regulation and 145 for social regulation which were analysed.

The following step was that the authors read all the selected abstracts. When a decision could not be taken whether the article had relevant information by reading the abstract alone, the results and discussion sections were also read. The main reason for rejecting articles were that they focused on aspects other our aim. A significant number of articles addressed aspects of co-regulation in relation to the parental relationship -59-, breastfeeding -57- or development at early childhood stages -23-. Therefore, out of the 225 articles from the co-regulation and social regulation search, 5 were selected for a complete reading adding to the 19 articles coming from the search using SSRL and SSM. Finally, out of those 24 selected articles only 10 addressed empirical evidence related to our aim.

Finally, the ‘snow-balling’ method was used which consist in selecting new articles that could be of interest based on the content and references of the articles already chosen. Using this method seven additional articles (3 theoretical and 1 empirical) were included. In February 2013 a new search was conducting using only three of the keywords (socially shared regulation, socially shared metacognition and co-regulation) finding the same number of hits for each keyword. In June 2014 the procedure was repeated and one additional article was included in the review.

2.3. Method of analysis

Due to the fact that the socially shared regulation field has just recently been developed, this review is of a qualitative nature, the approach adopted being narrative content analysis (Dochy, 2006). The main purpose in terms of our analysis is to identify patterns in the research on the field and whether it can be concluded that, based on the existent empirical evidence, socially shared regulation theoretical concepts can be maintained. The possibility of conducting a meta-analysis was excluded as there are a restricted number of studies on the topic and most of them explore the phenomenon using qualitative approaches.

The selected articles were read and coded to explore their relevance for this study aim. Different information was extracted and included in a table (see an abbreviated version in Table 1):

type of study, sample, subject/task, method/type of data, data analysis, procedure, results and evidence on SSRL. Then the information was contrasted to find the research patterns, to extract conclusions from the studies and to judge the direction of future research.

3. Results

A total of 13 of the 17 selected articles presented empirical data on the existence of SSRL. We next describe these results organized around two sections: evidence on SSRL and features of SSRL research, offering the most salient characteristics and findings of the current SSRL research.

Insert Table 1.

3.1. Evidence on SSRL

All of the empirical articles – excluding the two reviews and the three theoretical papers – show empirical evidence on the characteristics of SSRL (see Table 1). In particular, the results point to a distinguishably collaborative work regulation level called socially shared regulation or socially shared metacognition. Seven of the articles differentiate between co-regulation and SSRL in terms of the latter being a more jointed approach to collaborative work (e.g. Volet & Mansfield, 2006), while the other half just characterise SSRL without presenting empirical data about co-regulation or other types of regulation (e.g. Iiskala et al., 2011). When considering different aspects of the evidence on SSRL, we will first present how SSRL is characterized from the reviewed studies, as expressed in our first research question. Second, we will focus on the studies comparing SSRL and co-regulation to answer our second research question. Third, we will analyse what is the interaction of SSRL and other studied learning variables. Finally, we will analyse the evidence on the relationship between SSRL and performance. These two last sections will answer our third research question.

3.1.1. Characterizing SSRL

When considering the evidence for SSRL, one of the most important features of the research conducted is to characterize how SSRL happens in a process of collaboration. It is a common practice for the papers addressing SSRL to present examples, mostly verbal interactions, regarding how SSRL works within the groups that participated in the studies, making visible how the process developed and characterizing the results. The most salient features of SSRL that have been identified are in terms of shared regulatory activities, joint regulatory strategies (e.g. planning), group motivational efforts, and emotion regulation.

The use of joint regulatory strategies can be found in one of the earliest work in the field, Iiskala et al. (2004). They found evidence on how high achieving dyads regulated their joint cognitive constructions by shared monitoring of their progress and adapting their performance. The authors represent the analysis of the dyads through interaction flowcharts using two types of arrows to differentiate between inter-individual metacognitive actions and inter-individual cognitive actions. They concluded that inter-individual metacognition was an observable phenomenon and that the dyads could monitor and regulate their performance jointly. In a similar fashion, Hurme et al. (Submitted) shows how six triads used different regulatory strategies named metacognition, verifying, implementation, exploration, analysis, among other strategies at the group and task level. They concluded that socially shared metacognition was a “*differentiator making problem solving successful in groups*” (p. 28). Similar cognitive and metacognitive shared strategies traces can be found in Iiskala et al. (2004), Volet and Mansfield (2006), Hurme et al. (2009), Volet et al. (2009), Iiskala et al. (2009), Järvelä and Järvenoja (2011), Rogat and Linnenbrink-Garcia (2011), Grau and Whitebread (2012), Janssen et al. (2012), DiDonato (2013), Järvelä et al. (in press), and Hurme et al. (submitted).

The characteristics of shared regulation of motivation and regulation of emotion have also been explored. For example, Rogat and Linnenbrink-Garcia (2011) analysed six groups collaborative work in three different tasks exploring the role of emotions on SSRL. They included the following

categories (which had different sub-categories): social regulation, positive socio emotional interactions, negative socio emotional interactions, collaborative interactions and non-collaborative interactions. They reported four main results and explored the role of emotions concluding that “*Negative socioemotional interactions also appeared to diminish the quality of social regulation*” (p. 410), the more interactions with negative valence the more problems for the group and for SSRL to occur. Volet and Mansfield (2006) found that the two groups analysed shared regulated motivation and emotion in different fashion depending on the personal goals of the group members. As an example, they found group members using a group contract to motivate members that were not collaborating. Also, Järvelä and Järvenoja (2011) explored shared regulation of motivation in four groups of four members each. They found that the students activated a number of joint motivation regulation strategies (e.g. social reinforcement), which were used and enhanced by the interactions of the group members. Other empirical articles that have addressed emotional and motivational aspects of SSRL are: Volet et al. (2009), Grau & Whitebread (2012), indirectly Janssen et al. (2012), and Järvelä et al. (in press).

3.1.2. Evidence of different levels of social regulation: SSRL vs. co-regulation

In this section we analyse the empirical evidence on the comparison of SSRL and co-regulation and if they unfold different collaborative processes. Again, one of the problems is in the use of the terminology (e.g. co-regulation is not always named that way). Out of the seventeen articles included in this review five of the empirical articles show direct empirical evidence of the comparison SSRL and co-regulation analysing their different features and effects. In addition two other articles (DiDonato, 2013; Janssen et al., 2012) show indirect empirical evidence of qualitative different types of social regulation. Next we present in detail the five studies showing the direct evidence.

First, Volet and Mansfield (2006) compared two small groups (size of the groups is not reported) of 3rd year Business students using interviews and a questionnaire on Students’ Appraisals

of Group Assignments (SAGA). They identified two forms of regulation that reflected in each of the two different groups analysed, influenced by the goals the group members had. *“Overall, the two small groups of students reflected two distinct mind-sets and related regulatory approaches. Students with negative appraisals and an exclusive focus on performance tended to be more self-centered and saw group assignments in terms of themselves within the group. Consistent with that approach, their regulatory strategies (often maladaptive to the group activity) displayed elements of control, direction and empowerment. In contrast, students with positive appraisals and multiple goals (performance, social and learning) were at least in part, focused on group learning outcomes. They perceived group assignments in terms of group dynamics and their regulatory strategies reflected facilitation, modeling and empowerment”* (p. 13). The most adaptive type of social regulation was named as “self-regulation in cooperation”. Therefore, there are three main findings four our research purposes: (a) they identified different levels of social regulation, (b) one of the two levels showed better effects on the group collaboration and (c) they explored the effect of different types of goals on the occurrence of SSRL.

Second, Volet, Summers and Thurman (2009) identified different levels of co-regulation in eighteen 2nd year veterinary students (groups of six members). There are two aspects to remark before we present their findings. First, Volet et al. presented a theoretical framework with four areas (p. 131) based in two continuums: Individual regulation vs. Co-regulation, and Low level knowledge constructions vs. High level. Second, what they are referring as high co-regulation is a close concept to SSRL (e.g. page 131). Their two main conclusions were that (a) it was possible to find evidence of the four areas, meaning that it is possible to differentiate among different types of social regulation, and (b) there is a higher level of co-regulation characterized by the use of joint regulatory activities and higher knowledge construction.

Third, Rogat and Linenbrick-Garcia (2011), of which we have already presented some findings, found differences in the quality of social regulation identifying that positive socio

emotional interactions ensured more informal ways of giving feedback and monitor as a group. This produced differences in the groups' activation of cognitive and behavioural regulation which resulted in high quality regulation if the groups had interactions with positive valence. In sum, they also found evidence for different levels of social regulation and explored the influence of the socio emotional interactions valence in the occurrence of SSRL: if the valence was positive the joint activity enhances.

Fourth, Grau and Whitebread (2012) observed the interactions of eight 3rd graders while working in two groups during five sessions. The authors explored the intentionality of actions as categorized in three levels: self-regulation -directed to regulate the student's own activity-, co-regulation -regulate the activity of another member of the group-, and shared regulation -regulatory activity directed to regulate the collective activity-. The main findings are (a) individual and social regulation are related, (b) primary students are already able to engage in shared regulation actions, (c) two categories of social regulation could be identified and (d) shared regulation led to higher *"talk about essential aspects of the task, such as relevant knowledge"* which could lead to higher learning.

Fifth, Järvelä, Järvenoja, Malmberg and Hadwin (2013) identified three types of SSRL in eighteen graduate students working as triads. They did not consider co-regulation in between the collaborative interactions by the individual group members, but characterized strong, progressive and weak SSRL processes. The main findings are that (a) groups with different profiles reported different types of learning challenges, (b) there were differences on the type of shared strategies the groups used (more deep strategies in the strong SSRL) and (c) there seems to be a relationship between type of SSRL and performance.

3.1.3. Evidence on the interaction of SSRL and other learning variables

There are four variables that have been studied in relation to SSRL: goals (Volet & Mansfield, 2006), feelings of difficulty (Hurme et al., 2009), content processing (Volet, Summers,

et al., 2009), and performance (see the next section for the latest research). Volet and Mansfield's (2006) study indicated that the appearance of co-regulation and SSRL was triggered by different goals: co-regulation was triggered by individual and control goals and SSRL by collaborative goals. They explained these results as "*during group activities, personal goals and perceptions of teaching and group contexts interacted dynamically to produce regulation strategies compatible with goal pursuits*" (p. 12). Nevertheless, there is still a need for research into how different goals (individual or group-related) might trigger SSRL. Hurme et al. (2009) included feelings of difficulty as a variable, exploring whether experiencing socially shared regulation helped the students to feel tasks were less difficult. Their main conclusion is that when students expressed socially shared metacognition, their experience of difficulty in the task decreased. Volet et al. (2009) studied two separate but related concepts: social regulation and content processing. Each had two continuums: social regulation could move between individual self-regulation and group co-regulation, while content processing could move between low-level knowledge acquisition and high-level construct meaning. One of their findings was that high-regulated groups showed a higher level of construct meaning, but they left the door open to interpretation: '*...it is impossible to ascertain whether participation in high-level co-regulation lead to greater academic performance, or whether higher-performing students had already developed interactional styles that emphasised high-level co-regulation ...*' (p. 141).

3.1.4. Performance. Only three studies (Janssen et al., 2012; Järvelä et al., 2013; Volet, Summers, et al., 2009) explored directly whether SSRL produces better learning outcomes, and one additional article shows indirect evidence about this relationship (Grau & Whitebread, 2012). While two of the studies found that the groups showing the highest levels of SSRL were those with higher performance (Janssen et al., 2012; Volet, Summers, et al., 2009) the other outlined similar results, but without more detailed discussion (Järvelä et al., 2013). The fourth article (Grau & Whitebread,

2012) shows that shared regulation led to higher reflection about the most important features of the task which should lead to higher learning.

3.2. Features of SSRL research

Next, we analyse different common features of the SSRL research to offer a clearer picture of the field, in order to answer our fourth research question.

3.2.1. Sample. The empirical studies include participants from primary education (five studies), middle school (one study), secondary education (one study) and higher education (six studies), showing evidence of SSRL from a broad range of educational levels. In terms of participants with specific characteristics, a line of research has focused on analysing high-achieving students, mainly interacting peers, and trying to characterize how they collaborate (Iiskala et al., 2011; Iiskala et al., 2004; Vauras et al., 2003).

3.2.2. Subject or task. The following were explored: science (one study), business (one study), veterinary physiological principles (one study), history (one study), interdisciplinary project (one study) educational psychology (two studies) and mathematics (six studies). Therefore, it can be observed that the occurrence of SSRL has been explored in relation to a variety of tasks, with a clear special focus in the field of mathematics. Nevertheless, there is almost no discussion in the current research about the importance of collaboration for those tasks. It is not stated why/how collaboration is crucial in those activities, how the collaborative tasks were designed and, therefore, whether SSRL would be crucial in a real classroom setting. In addition there is as significant number of studies conducted using CSCL environments.

3.2.3. Method and type of data. The reviewed studies have a clear tendency towards mixed methods using qualitative data, mostly video-recorded observation data. Only two articles use a questionnaire in combination with interview (Järvelä & Järvenoja, 2011; Volet & Mansfield, 2006) and another article uses questionnaires plus a case study (DiDonato, 2013). Since the majority of

studies have aimed to characterize SSRL, the methodology is based on observation and analysis of cases as, through that data, it is possible to identify how SSRL works and what its features are.

In terms of the research design, all the studies are descriptive, with most of them using naturalistic tasks embedded in the curriculum. There are no experiments or quasi-experiments with control groups. The lack of this type of research could be considered an important flaw, but at the same time, now that the SSRL phenomena has been characterized it might be time to start aiming for interventions in either controlled or natural contexts to determine the key factors that promote the appearance of SSRL.

3.2.4. Data analysis. The type of data collected allows for analysis of the group interactions by means of sociocultural discourse, verbal transactions, non-verbal communication and content analysis. The video data is coded and analysed, aiming to explore the social aspects of the interactions. One example can be found in Iiskala et al.'s (2011) study in which they used different interaction flowcharts and presented two types of arrows, one for inter-individual metacognitive actions and another for inter-individual cognitive actions. Another example would be the study by Volet et al. (2009) based on four categories of social interaction: high-level co-regulation, high-level individual regulation, low-level co-regulation and low-level individual regulation. These coding systems are representative of how the different researchers conceptualize the socially shared regulation phenomenon.

3.2.5. Size of the groups. One aspect of SSRL research to be noted is the lack of discussion about group size: it is never stated why one amount of students is used and not another, or whether there is an ideal amount of participants for SSRL to occur. Nevertheless, there is a wide range in the size of the groups (Table 1): dyads (three studies), triads (four), four members (three), six members (one) and non-stated (one). It can be extracted, then, that SSRL can be identified in the smallest possible collaboration – a pair – up to big groups consisting of up to six members.

4. Discussion

The aim of this article was to review the empirical evidence on socially shared regulated learning (SSRL) including socially shared metacognition. We had four research questions: (1) What are the main characteristics of SSRL, (2) Can different levels of social regulation be identified (SSRL vs. co-regulation), (3) What is the relationship of SSRL and other studied learning variables, and (4) What are the salient features of SSRL research. Next we present our conclusions based on the empirical evidence to these research questions including limitations of the existent research. We also consider the limitations of this review and discuss general future lines of work.

4.1. Main characteristics of SSRL

As conclusion, the empirical articles reviewed characterized SSRL as the joint regulation of cognition, metacognition, motivation, emotion and behaviour. Traces of SSRL can be found in the collaboration of different size groups (from dyads to six member groups) in the same just mentioned components that the classical self-regulation field has explored (e.g. Zimmerman & Moylan, 2009). In this sense the model introduced by Hadwin et al. (2011; Järvelä & Hadwin, 2013) is a relevant proposal to develop the SSRL field as it is based in the self-regulation field and comprehends these different components.

One important reflection is the lack of a consistent use of the terminology in two terms socially shared regulation and socially shared metacognition. The two most common definitions have been socially shared regulation (e.g. Hadwin et al., 2011; Järvelä et al., 2013) and socially shared metacognition (e.g. Hurme et al., 2009; Iiskala et al., 2004). It seems that in some cases those terms have been used interchangeably, and there is a need to consider that both might be used for purposes other than their original theoretical foci. According to Dinsmore et al. (2008), there are some parallels between the concepts of self-regulated learning and metacognition: the first one usually emphasises, in addition to cognition, the importance of the emotions and motivation, while

the second aims more at cognitive processing. Here we propose a similar use: socially shared metacognition could be used when the study covers aspects of cognition and metacognition and socially shared regulated learning (SSRL) when, on top of cognition and metacognition, motivational and emotional aspects are covered in the study.

4.2. SSRL vs. co-regulation

Our second research question addressed the possible distinction of two levels of social regulation. Is there empirical evidence on differences between co-regulation and SSRL, and what would those differences be? Five of the studies showed direct evidence, and two additional studies indirect evidence. Therefore, it can be maintained that regulation of learning in collaborative situations shows different levels and characteristics. The reviewed research results show that there are at least two types of collaborative regulation of learning. First, an unbalanced regulation of learning usually known as co-regulation in which one or more group members regulate others member's activity. Second, a more balanced approach to collaborative learning in which the group members jointly regulate their shared activity usually known as SSRL or socially shared metacognition. The differences among both types have been described in great detail in the existent research in terms of cognitive, metacognitive, motivational and emotional aspects.

In theory, Hadwin, Järvelä & Miller (2011) argue that learners self-regulate, co-regulate, and share their regulation of learning whenever they work on shared tasks. Instead of investigating co-regulation and SSRL as different phenomena, the roles of self-regulation, co-regulation and SSRL should be considered all as build into each other (see for example Grau & Whitebread, 2012). The idea that we want to express here is that, with the current empirical evidence, even if SSRL seems to have more learning benefits it can still be the case that co-regulation occurs also in some periods in groups that mostly socially shared regulate (SSRL). This would be the case as groups progress through different phases on their collaboration and not always SSRL nor will co-regulation happen in isolation.

A clearer use of the terminology is again needed. The most spread use has been naming co-regulation to the less shared balanced type of regulation, and SSRL to the joint one. The field is still growing, and the terminology could change, but new studies should consider this taxonomy and use it or at least related to it when presenting new categories so that the new ones are easily understood and adapted to the already existing framework.

4.3. SSRL in relationship with other learning variables

The results from three studies show the tendency for SSRL to increase group performance and a fourth study indirectly shows evidence also for individual learning. This is a crucial finding, as more use of learning strategies or self-regulation does not always lead to higher performance (e.g. Panadero, Alonso-Tapia, & Huertas, 2012), and therefore SSRL can also have counter-effects, which have not yet been identified in research. Nevertheless, the number of studies that have explored the effect of SSRL on performance is surprisingly low. We consider it important for the incoming research to provide more evidence on this effect, to establish whether SSRL promotes higher performance in group tasks. In sum, there is a need to clarify whether socially shared regulation always benefits the group members' learning, how co-regulation is connected to SSRL and/or under what circumstances this happens. Therefore, our claim is that future research should include measures of performance as a way to validate the relevance of SSRL for learning.

With regards to the other three learning variables that have been explored (goals, feelings of difficulty and content processing) it is precarious to extract conclusions due that each of them has only been studied once. Three aspects seem to us of major importance in the future research. First, exploring of how the individual goals that each member brings to the group affect the occurrence of SSRL, in line with Volet and Mansfield (2006) research. Second, what type of shared goals groups construct and if the individual goals taxonomy applies (e.g. performance, avoidance and learning). Third, the socio emotional variables seem to have a role in SSRL (Järvelä, et al., 2013), but it is still not much investigated.

4.4. Salient features of the SSRL research

The majority of research has used descriptive data. The existing studies have mainly explored the existence and characteristics of socially shared regulation, and for that purpose, observing what groups actually do is a key research method. The aim of these qualitative approaches is to explore social interactions and exchanges, and that is the type of data that supports those analyses. These methodological advances to conduct research on interpersonal regulation (see Volet & Vauras, 2013) have potential for unfolding the individual and social interaction processes of regulation in learning, but there is a challenge in developing validated instruments and analytical techniques to move the field forward through the use of research questions other than those already answered. And in relationship to the descriptive nature of the data future research should conduct experiments or quasi-experiments as, without control groups, it is difficult to determine (a) the real learning gains, (b) how to better differentiate SSRL from co-regulation and (c) the key factors that trigger SSRL and how to promote them.

Compared to the traditional self-regulated learning research (Boekaerts & Corno, 2005), a low number of self-report tools have been applied in SSRL research. Only two self-reports have been used in SSRL research so far: SAGA (Volet & Mansfield, 2006) and AIRE (Järvenoja, Volet, & Järvelä, 2012). Nevertheless, even though self-reports have some problems when used to measure students' strategy use, in the SSRL line of research it would be valuable to validate self-reports against the process data that has been the main approach so far. Students could be asked about their collaborative skills and their perceptions of group work to explore the aspects they consider fundamental to achieve SSRL. In sum, at this point, self-reports could actually amplify our understanding of students and serve to answer new research questions.

4.5. Limitations of this review

One clear limitation of this review is that the SSRL is a new field. The first study dated to 2003. Even if since 2009 there has been a considerable increase in the number of publications, there are still a low number of studies addressing SSRL. Therefore, our conclusions should be put into context of future studies to come.

Another limitation is the nature of the empirical evidence available. Most of the studies are descriptive in essence. This lack of empirical research impedes causal attributions, and when using correlational data, as the one from the SSRL, the conclusions have to be done with care. Therefore, there is still a need for more research especially using experimental designs to ensure controlled results.

4.6. Practical implications

The main implication for teaching purposes that can be extracted from this review is that teachers should promote learning environments leading to SSRL collaborative work. Unfortunately, the environmental and pedagogical factors that trigger SSRL have not been explored yet. Nevertheless, we can extract some ideas that could be beneficial for SSRL. First, teachers should encourage working groups to have share responsibility for their actions and equal power relationships. If one student takes the role of leader with negative consequences (e.g. ordering to the other groups members what do to) there would be less shared decisions. Second, teachers should promote opportunities for the groups to plan, monitor and evaluate their work. This can be done using tools (e.g. rubrics), modelling the groups and allocating time for the groups to plan and evaluate their work before and after the performance. Third, teachers should point out that the group processes (e.g. members' motivation) is also part of the activity. Giving some attention to these types of processes would make them more salient for the groups and students would start paying attention not only to the final outcome but also to the collaboration itself.

4.7. First general line of future research: Self-regulation at the personal level and other individual characteristics

As Winne, Hadwin, and Gress (2010) claim, little and sometimes no attention has been focused on the resources each group member brings to a collaboration: prior knowledge, task-relevant information which is not yet transformed into knowledge and the cognitive processes used to construct these informational resources. This claim is also transferable to the current situation in SSRL research. The studies analysed in this review do not explore how different individual variables of the group members might promote or disturb the occurrence of SSRL. Among these, it seems of special relevance to explore how individual self-regulation skills affect the collaborative work, thus SSRL. For example, can SSRL emerge in groups in which students have low individual self-regulation? Our claim is that for SSRL to emerge, the members need to have advanced self-regulation skills, as it is more difficult to regulate at the group level than at the individual one (Winne et al., 2013). And, actually, there are a number of SSRL studies in which the sample was composed of advanced students (e.g. Vauras et al., 2003). Only one of the selected studies addressed connections between SSRL and SRL (Grau & Whitebread, 2012).

Another important individual characteristic is the level of social skills that different students could bring to the group, and how this could affect their perception as experts or otherwise within the group. Previous research on the topic has already pointed out that students perceived as leaders might contribute to different types of group regulation (Salonen et al., 2005). Also group dynamics of collaboration (Salomon & Globerson, 1989) should be considered, since if one student feels and is perceived as more of an expert, SSRL might not happen, as the other group members might consider it better to follow the “expert’s” guidance. This point was approached theoretically by Salonen et al. (2005) under the name of asymmetry. *“Our study with collaborating peers provides some evidence, but peer relations are different from teacher-student relations, where there is*

asymmetry in social status in the group as well as in the cognitive and motivational background" (p. 206).

In conclusion, the main idea that we seek to transmit here is that, even if the group is a separate entity and different from the students working in isolation, it is also the sum of all its parts (Dillenbourg, 1999). Looking at the different members' characteristics can be crucial in better understanding how and when SSRL happens. For example, aspects such as friendship, emotional security, and so on might be crucial for the activation of SSRL skills within the groups. Therefore, looking not only at what happens during the SSRL but also what the students bring to the interaction will help us clarify how to promote SSRL.

4.8. Second general lines of future research: The importance of the learning task and developing interventions

There are two other aspects that SSRL could explore in more detail. First, the review shows that there is a lack of argumentation in the current research regarding why the different tasks were chosen for the studies. Actually, the tasks used in the existing studies varied from computer-supported collaborative learning and peer learning tasks to group tasks. It is not clear in these studies whether the task definition was such that the students had a real need to collaborate and share their ideas (Dillenbourg, 1999). The task type and the degree of coordination of shared activities (Barron, 2000) seems to be crucial if we want to promote SSRL since, from our review, it can be concluded that SSRL may enhance performance. Therefore, more attention and argumentation about the type of task chosen is needed.

The second aspect of SSRL that needs research is the implementation of interventions to enhance SSRL. The current research has characterized the phenomenon, but there are no studies trying to implement an intervention to promote SSRL and making comparisons with a control group. With the findings from this review in mind, implementing interventions would be a positive

step to increase students' performance and learning. Another step in the field is to conduct interventions that scaffold and support dynamics to promote SSRL. This is especially potential in the field of CSCL, since group processes are in the center of CSCL and the opportunities to support regulatory processes exist in the available technology (Järvelä et al. 2014).

4.9. Third general line of research: on the comparison of SSRL vs. co-regulation including developmental aspects

This review results indicate that there are different types of social regulation that occur in collaborative learning (Hadwin et al., 2011). Future research needs to clarify in more detail what are the characteristics of each in addition to the ones presented here. In this comparison it will be important to consider the developmental aspects of the students, not only in terms of age but also on their expertise in the task. First, more clarification is needed if and how different group age students shared their regulation. In the studies reviewed here there is a big range in age groups but there were no enough clarification that we could extract conclusions from. Second, it could be the case that students need to have some expertise on the task at hands or previous experience in collaborative tasks for SSRL to occur. Third, more ambitious efforts need to be undertaken to reveal what could be impact of individual development of self-regulatory skills on the occurrence of SSRL when working in teams. At the same time it should be explored what collaborative skills are needed to develop before students can successfully share regulate. These three aspects need to be investigated.

4.10. Fourth general line of research: a call for theoretical clarification

There are two main areas where more conceptual clarification is needed. First, SSRL scholars should address in more depth what are the implications of Vygotsky's and other socio-cultural research's work for SSRL. Even if this discussion goes beyond the scope of most of SSRL empirical papers the field would benefit from establishing the connections between SSRL and Vygotsky's work. One of the benefits could be a better understanding of the developmental aspects

needed for optimal SSRL. Second, a more thoughtful use of the terms socially shared metacognition and socially shared regulation would also help on the development of the field as has been already argued in the discussion section.

4.11. General conclusions

Based on the review, our recommendation is that future lines of research should not focus exclusively on characterize and describe SSRL but, as explained above, on advancing the field in three other dimensions: first, exploring the best conditions and different factors to promote SSRL. We now know how social interactions happen when SSRL occurs, but there is a need for interventions to promote it so that we can implement it in more general learning contexts (e.g. bigger classroom groups or in computer supported collaborative learning settings). Promising results have been found regarding the use of technology tools in prompting self-regulation (Winne et al., 2006) and co-regulation (Azevedo, Cromley, Winters, Moos, & Greene, 2005), but it is still rare for tools to be leveraged in SSRL regulation support (Järvelä & Hadwin, 2013).

Second, there is a need to clarify the role of co-regulation in SSRL. The empirical research shows some evidence that co-regulation is built in SSRL (e.g. Grau & Whitebread, 2012), but more is needed to complete our understanding of the relationship between these two types of shared regulation. It seems that instead of being an on/off type of relationship it is more complex and even subordinated. There may be at least two variables that could explain how groups move between co-regulation and SSRL: group dynamics and level of expertise (asymmetry). Therefore, future research needs to address a more in depth understanding of the dual interaction of co-regulation and SSRL, what can be the benefits of which one and under which circumstances, and what triggers one or the other.

Third, there is a need to explore more aspects of groups' characteristics. The current research on SSRL has not addressed in detail questions regarding size of groups, characteristics of members (e.g. SRL skills), individual social abilities, etc.

In conclusion, it can be extracted from the empirical evidence that SSRL is a real phenomenon that occurs within collaborative groups in joint learning situations (e.g. CSCL). Even though the field is a new and growing one, a number of important features of SSRL have been already explored. Nevertheless, there is still a long road ahead to continue discovering aspects of SSRL and how to create the best learning environments to promote the adoption of this approach in the collaborative work and CSCL.

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Table 1
Summary studies on shared regulation

Study	Type	Sample (& country)	Task	Type of data	Main conclusion
Vauras, Iiskala, Kajamies, Kinnunen & Lehtinen (2003)	Descriptive exploratory study	One pair high-achieving 4th graders (Finland)	Mathematics	Observational data (video)	Characterized SSRL in a high-achieving pair of 4th graders.
Iiskala, Vauras & Lehtinen (2004)	Empirical	Four 4th grade high-achieving pairs (Finland)	Mathematics (Quest of the Silver Owl)	Observational data (video)	An approach to studying shared metacognition adding the idea of mutuality, simultaneity and sharing.
Salonen, Vauras & Efklides (2005)	Theoretical paper	Two studies conducted on the topic (Finland)		Theoretical reflection	Different aspects of the future to be socially shared metacognition are presented: scaffolding and how to make it optimal, perceptions of students' metacognitive experiences, and other fundamental aspects.
Volet & Mansfield (2006)	Empirical	Eighteen 3rd year Business students. Unknown members per group (Australia)	Business small group assignment.	Interview and questionnaire	Distinguished the role of different goals and their effects on approaches to collaborative work (co-regulation vs. SSRL)
Hurme, Merenuoto & Järvelä (2009)	Descriptive exploratory study	Two triads of pre-service primary teachers. (Finland)	Mathematics	Descriptive. Through the interactions in WorkMate (a CSCL tool)	Characterization of the SSRL in combination with feelings of difficulty: triads solving mathematical problems
Volet, Summers & Thurman (2009)	Empirical	18 second-year veterinary science students' (groups of six) (Australia)	Physiological principles applied to veterinary cases.	Case study (observational procedures) embedded in real classrooms. Video data collection and analysis.	Different levels of collaborative work based in 4-pole axis matrix: social regulation (SSRL vs. co-regulation) and content processing (low-level knowledge acquisition vs. high-level construct meaning)
Volet, Vauras & Salonen (2009)	Theoretical review		Co-regulation theories	Narrative review	They compared different traditions views on interactions during joint activity. Analysis of the origin of the shared regulation term. Futures lines of research especially on clarifying other-regulation and co-regulation.
Castelló, Bañales & Vega-López (2010)	Theoretical review		Different theories driven interventions on the writing field	Narrative review	They identified four approaches to the study of the writing process: (a) cognitive perspective starting with Hayes & Flower work, (b) Sociocognitive perspective: ideas from Zimmerman including motivation and emotion, (c) Sociocultural perspective: writing is a social process that develops within a community, and (d) Socially shared perspective: taking ideas from Hadwin & Järvelä.
Iiskala, Vauras, Lehtinen & Salonen (2011)	Empirical	Four high-achieving dyads (Finland)	Mathematical word problems	Observational data from case studies.	Presents data clarifying the features of SSMetacognition
Hadwin, Järvelä & Miller (2011)	Theoretical chapter			Theoretical reflection	Outlines the differences between individual SRL, co-regulation and socially shared regulation. The key feature that distinguishes SSRL from co-regulation is that the group, as a unit, shares convergent regulation of the team activity through planning, monitoring, evaluation and regulating the motivation, emotion, cognition and behaviour.
Järvelä & Järvenoja (2011)	Empirical	Sixteen first year graduate from an educational course. Four members groups. (Finland)	Educational psychology	Observational data (video), interviews and self-report (AIRE)	Shows that SSRL emerged when students worked in collaboration and made efforts to regulate their learning and engagement
Rogat & Linnenbrink-Garcia (2011)	Empirical	Six four-member groups of sixth-graders (USA)	Mathematics	Observational data (video)	Data on different levels of social regulation linked to co-regulation and SSRL
Grau & Whitebread (2012)	Descriptive exploratory study	8 third grade working in four- members groups. (UK)	Science subject.	Case study (observational procedures) embedded in real classrooms. Video data collection and analysis.	SSRL vs. co-regulation – most salient features of each of them.
Janssen, Erkens, Kirschner, & Kanselaar, (2012)	Empirical	310 secondary education students (15-18 years). 5 th year of the pre-university track. Mostly triads but also pairs and four-member groups. (Netherlands)	History tasks. Virtual Collaborative Research Institute (VCRI) tool	Cases studies	They found that groups regulate their task performance in a regular basis mostly planning the task (19.51%) and monitoring task progress (14.03). Discussing information and regulation of task-related activities did not predict group performance. Positive effect of regulation of social activities on group performance.

DiDonato (2013)	Empirical descriptive	64 middle school students (Ages 12-14). Unknown group number. (USA)	Interdisciplinary project	Descriptive. Quantitative: questionnaires & qualitative: case analysis.	Co-regulation as measured by the questionnaire mediated the use of SRL in the group. The case study data showed that the group had strong other-regulation that most probably helped to achieve the task goals. There was also some shared-regulation but it happened less frequently.
Järvelä, Järvenoja, Malmberg & Hadwin (2013)	Descriptive exploratory study	18 graduate students in a Master's program working in triads (Finland)	Educational psych. course	Descriptive. Quantitative data using nStudy	They identified three types of SSR: strong, progressive and weak. They also explored the relationship of SSR and performance, resulting in three levels of performance (strong, improvers and weak).
Hurme, Merenuoto, Salonen & Järvelä (sent for publication)	Descriptive exploratory study	45 pre-service primary teachers (working in triads) (Finland)	Mathematics	Descriptive. Through the interactions in WorkMate (a CSCL tool). And quantitative using self-reports.	Characterization of the socially shared metacognition phenomena.