Master Thesis

Evaluating the Combination of the Individual Planning Tool and Shared Planning Tool to Foster Socially Shared Regulation in a Collaborative Environment

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June 2023

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Acknowledgements

In front of you lies my master's thesis on socially shared regulation of learning in a collaborative setting. As I near its completion, I want to express my deepest gratitude to all those who have supported me throughout this challenging journey. With this thesis I will be finished with my study and will leave the University of Twente after five wonderful years.

First and foremost, I extend my sincere thanks to my supervisors, Alieke and Hannie. Their exceptional expertise, continuous guidance, and support have been instrumental in shaping the course of my research. Their profound knowledge, insightful feedback, constructive criticism, and dedication to my academic development have been invaluable.

I am also grateful to my family, friends, and loved ones. Their constant encouragement, understanding, and belief in my abilities have served as a continuous source of motivation, helping me overcome the most challenging times. A simple conversation or text lighted up my day from which I found more confidence in my work. A special appreciation goes out to my loving boyfriend, whose unwavering support, understanding, and encouragement have been the foundation of my success. His belief in my abilities and attentive listening make me feel incredibly blessed.

Furthermore, I want to express my gratitude to the TopTraject for providing me with the opportunity to conduct this research. It was hard to find a school that wanted to participate. Their support in connecting me with a participating school has been invaluable. I am also immensely grateful to all the participants who volunteered their time and shared their invaluable insights. Without their willingness to take part, the findings of this study would not have been possible. I sincerely appreciate their involvement.

In conclusion, I invite you to delve into the pages of my master's thesis on socially shared regulation of learning. It represents the culmination of an incredible journey, made possible by the support and dedication of the individuals mentioned above. Enjoy!

Abstract

In modern education, the focus has shifted away from teaching with traditional teacher-led methods and towards a more student-centred approach, where greater emphasis is placed on empowering students in their learning journey. This transformation has led to the rise of group-based activities that foster collaboration and teamwork, allowing learners to actively engage in their education. This approach is believed to be more effective in promoting deeper learning and encouraging critical thinking skills. Communication problems, on the other hand, can obstruct group collaboration and negatively impact learning results in educational environments. Within the realm of collaborative learning, learners face the challenge of regulating both individual learning processes and the dynamics of the group. To overcome these obstacles, collaborative learning necessitates socially shared regulation (SSRL). Nevertheless, learners often encounter difficulties in demonstrating the necessary abilities to effectively regulate the collaborative process. To support learners in SSRL, Miller et al. (2013) and Hadwin et al. (2013) have developed two SSRL tools: the Individual Planning Tool (IPT) and the Shared Planning Tool (SPT). The IPT is designed for individual learners to engage in self-regulation of learning (SRL) by defining their goals and plans for the project. On the other hand, the SPT is designed for learners to externalise their goals and plans. The integrated use of the IPT and SPT offers a comprehensive framework that combines individual and collective perspectives to foster effective collaboration and self-regulated learning, promoting the development of metacognitive and collaborative skills in learners. By facilitating communication and coordination among group members, the tools can enhance SSRL. This study assessed the extent to which SSRL is supported during a collaborative activity while learners are asked to use the IPT and SPT. Through observations, audio recordings were collected to facilitate the coding and calculation of the frequency of SSRL. Furthermore, the relationship between SRL and SSRL is examined. Findings revealed a low prevalence of SSRL. A higher level of SSRL was expected since the IPT and SPT were implemented to foster SSRL. The tools usage and SSRL, however, were found to be negatively correlated, indicating that the SSRL tools did not foster SSRL. Moreover, the connection between SRL and SSRL was investigated, but no relationship was discovered. In conclusion, further research is required to identify the specific skills needed for learners to exhibit SSRL and to better understand how to encourage and facilitate SSRL in collaborative learning situations.

Introduction

Learning is increasingly being done in and with groups rather than being a solely individual and externally programmed activity (i.e., planned and executed with the aid of a teacher; Järvelä et al., 2015). As collaborative activities are increasingly integrated into classroom settings, there is a growing need to assess and enhance their effectiveness. Roschelle and Teasley (1995) propose that learners engage in collaborative learning when they construct knowledge through interactions with another person who is focused on achieving a shared goal. Collaboration has been proven to have a positive impact on learning, provided that learners interact properly (Dillenbourg, 1999; Järvelä et al., 2015; Kirschner et al., 2006; Slavin, 2014). This is because group interactions and members' responses within the collaborative setting led to the development of mutual understanding and shared comprehension.

Self-regulation can support effective communication and collaboration by aiding learners in observing and managing their communication behaviours to better serve the requirements of the group. Self-regulated learners evaluate their acts and change their behaviour to accomplish common goals by reflecting on their actions (Järvelä & Järvenoja, 2011; Järvelä et al., 2015). The successful regulation of the learning process is characterised by setting goals, planning, monitoring, and assessing one's learning progress before, during, and after a learning assignment (Zimmerman, 2002).

In collaborative environments, multiple self-regulating learners are brought together (Volet et al., 2009), requiring learners to regulate the group process as a whole. However, the regulation of the group process in a collaborative environment is not similar to self-regulation. The self-regulation theory is valuable for understanding cognitive processes in collaborative learning, but it ignores critical elements like motivation, emotion, metacognition, and strategic behaviour that have an impact on group dynamics and learning results (Järvelä & Hadwin, 2013; Järvelä et al., 2014; Järvelä et al., 2015; Malmberg et al., 2015). The benefits of collaborative learning could not be completely realised by students if these elements are ignored.

A useful strategy that considers the influence of motivation, emotion, metacognition, and strategies is socially shared regulation of learning (SSRL), which involves group members jointly regulating their activities (Järvelä et al., 2013; Hadwin et al., 2011). Instead of emphasising individual responsibility as SRL does, SSRL places more emphasis on collaborative

and interdependent regulation. SSRL is a socially embedded form of regulation within collaborative learning situations where learners actively coordinate group activities, including shared goals, feedback, methods, and decision-making. Using SSRL in collaboration has been shown to lead to improved interactions between learners (Fransen et al., 2011) and the co-construction of knowledge (Saab et al., 2012).

The degree to which group members acquire new knowledge depends on the success of group collaboration, which frequently arises from interaction issues (Kirschner et al., 2008; Roschelle & Teasley, 1995; Van den Bossche et al., 2006). Effective communication in SSRL involves behaviours such as active listening, giving feedback, sharing resources, negotiating meaning, and building on contributions. Moreover, clear expression, articulation of ideas and arguments, and respectful discussions are important components for successful communication in SSRL. This enables a shared objective and understanding, which are essential for effective teamwork and SSRL (Hadwin et al., 2011; Järvelä et al., 2016a; Kirschner & Hendrick, 2020). Without efficient communication, it may be challenging to coordinate the perspectives of the learners on the task, which may eventually make it more difficult for them to properly collaborate (Dillenbourg, 1999; Roschelle & Teasley, 1995).

Research shows that learners often struggle to display SSRL skills (Van den Bossche et al., 2006; Weinberger et al., 2007). Besides the fact that learners fail to communicate effectively, they may have a lack of understanding of what skills are required to successfully use SSRL in collaboration. Research has shown that learners often have a limited understanding of SSRL and its benefits (Järvelä & Järvenoja, 2011; Järvelä et al., 2013). They may not understand how to regulate their learning activities in collaboration. Additionally, learners frequently fail to recognise challenges that require SSRL, which is a crucial part of collaborative learning (Malmberg et al., 2015). Consequently, learners need to be aware of when the group needs to be socially regulated (Järvelä et al., 2013). Therefore, it is important to support SSRL using educational tools (Fischer et al., 2013). Several tools have been developed to support collaboration that might or might not influence SSRL in its slipstream (see Järvelä et al., 2016a). It is currently unknown to what extent learners are inclined and capable of using SSRL skills when these tools are implemented. Theory supports the use of these tools; however, current research on their effectiveness is lacking. This study, therefore, explores the possibility of supporting learners' SSRL skills in collaboration by using existing tools for collaboration.

Theoretical Framework

Collaborative Learning

In collaborative learning, learners build a mutual understanding through interaction with others who are devoted to or engaged in shared goals and issue resolution (Laal, 2013). Furthermore, learners participate in collaborative activities such as explaining, arguing, or recognising and resolving socio-cognitive issues to facilitate the deep elaboration of the learning material (King, 2007). Moreover, individuals share and elaborate on their viewpoints as part of collaborative learning to broaden their understanding and abilities (Chi, 2009; Chi & Wylie, 2014; Dillenbourg, 1999; Scardamalia & Bereiter, 2014; Webb, 2013). By collaborating, learners externalise their knowledge and alter their cognitive structures (King, 1997), leading to new learning opportunities (Molenaar et al., 2014). Collaborative learning, thus, offers promise for improving content-related and metacognitive skills in learners (Schnaubert & Bodemer, 2019).

The quality of the interactions that occur during collaboration (i.e., explaining and arguing), in particular the process of developing and maintaining shared understanding, determines the extent to which these group collaborations lead to the formulation of new knowledge (Kirschner et al., 2008; Roschelle & Teasley, 1995). Moreover, for collaborative learning to be considered effective, it is necessary to ensure that the benefits of learning outweigh the transactional activity costs involved (Kirschner et al., 2014). In a collaborative context, transactional activity costs refer to the cognitive effort and resources required to establish and maintain interactions between learners during collaborative learning activities. According to cognitive load theory, these costs can impact the overall cognitive load of learners and influence their ability to learn effectively (Sweller, 2010). Those that collaborate must use more cognitive effort than independent individuals since they are required to communicate and coordinate with their group members (Ciborra & Olsen, 1988; Kirschner et al., 2009). However, these interactions, such as exchanging information, negotiating meaning, and monitoring each other's progress (Kirschner et al., 2006), can increase cognitive load. If they require too much mental effort or attention, learners have less capacity to process new information or engage in productive learning activities. To minimise transactional activity costs and optimise cognitive load in collaborative learning, it is important to design learning activities that facilitate effective communication and coordination while minimising

unnecessary cognitive demands (Kirschner et al., 2006). Research has identified the necessity for collaboration to be supported in the cognitive, motivational, and emotional regulatory aims of group activities (Järvelä et al., 2015).

Unfortunately, research continually demonstrates that learners often fail to engage in appropriate collaborative learning (Van den Bossche et al., 2006; Weinberger et al., 2007). For learners at various levels, collaborative learning might pose challenges, such as cognitive understanding issues, motivational differences in learning goals and expectations, and socio-emotional communication and interaction problems that may lead to dysfunctional group dynamics (Barron, 2003; Järvelä et al., 2010). However, learners may have a limited understanding of how to interact with one another and struggle to coordinate their activities (Erkens et al., 2005; Janssen et al., 2007). According to Järvelä et al. (2016a), group members are frequently unaware of the goals and strategies of fellow group members. Consequently, learners fail to engage in the expected collaborative activities without coaching and miss collaborative learning opportunities (Järvelä et al., 2016a; Schnaubert & Bodemer, 2019).

Self-Regulation of Learning and Socially Shared Regulation of Learning

Most research has focused on self-regulation in individual learning situations while neglecting regulation in a social context (Hadwin et al., 2010). Individually, the strategic regulation of cognition, emotion, motivation, and behaviour enables learners to guide and optimise their learning processes while completing academic activities (Pintrich, 2000; Winne & Hadwin, 1998; Schunk & Zimmerman, 2008; Zimmerman, 2000). This is referred to as self-regulation (SRL; Zimmerman, 2000). The main processes during self-regulation are orientation, planning, monitoring, evaluating, and reflecting (Molenaar, 2011). Research has shown the importance of SRL since it increases learning performance (Dignath & Büttner, 2008; Müller & Seufert, 2018; Panadero et al., 2017; Zimmerman, 2013; Zimmerman & Martinez-Pons, 1988). Learners may use strategies like self-assessment and metacognition to efficiently monitor their individual understanding while engaging in SRL (Panadero & Alonso-Tapia, 2014a).

However, in a collaborative learning environment, learners need to monitor a shared understanding to facilitate their group activities and effectively collaborate with others (Hadwin et al., 2016). Strategies such as summarising, questioning, clarifying, and regulating can be used to achieve a shared understanding (Dillenbourg et al., 1996; Zimmerman, 2008). Järvelä and Hadwin (2013) suggest that successful collaborative learning requires one to self-

regulate during group activities, but SRL is not enough to ensure this happens (Järvelä & Hadwin, 2013). Therefore, learners need to regulate at a group level. However, as the regulation of learning can be argued to be challenging on an individual level, it is even more difficult on a group level (Järvelä et al., 2015; Winne et al., 2013).

Collaborative activities involve multiple learners who are self-regulating, which means they need to consider the cognitions of peers and groups (Järvelä et al., 2015; Volet et al., 2009). The mechanisms through which group members control their collective behaviour are referred to as socially shared regulation of learning (SSRL). The theory behind SSRL builds on the SRL learning theory by expanding ideas of learning beyond individual-level cognitive processes and results. Motivation, emotion, metacognition, and strategic behaviour all play dynamic roles in successful learning, according to SSRL (Zimmerman & Schunk, 2011). Hadwin et al. (2011) propose that regulating motivation, cognition, and behaviour through metacognition is crucial for regulating learning. In SSRL, all group members negotiate and adapt a regulation process towards the goals set by the group (Järvelä & Hadwin, 2013). By using SSRL, work done in collaboration becomes more productive and efficient as a result, which enhances learning outcomes (Järvelä & Hadwin, 2013). While SRL occurs when learners create individual personal goals and alter individual strategies to achieve these goals, SSRL includes collective goals that are established within a group. Additionally, SSRL facilitates the sharing of task representations and goals among group members, further promoting effective collaborative learning (Hadwin et al., 2016).

Combining self-regulation (SRL) and socially shared regulation of learning (SSRL) in collaborative settings can significantly increase the effectiveness of collaboration by promoting deeper learning, fostering metacognitive development, enhancing task understanding, and facilitating collective knowledge construction. First, the combination of SRL and SSRL promotes deeper learning. While SSRL offers possibilities for peer feedback and reflection to improve comprehension, SRL enables learners to control their cognitive and metacognitive processes (Zimmerman, 2002; Järvelä & Hadwin, 2013). Second, through SRL and SSRL, people can develop their metacognitive skills by understanding their own learning needs and having metacognitive conversations (Zimmerman, 2002; Järvelä & Hadwin, 2013). Clear objectives and shared knowledge enable well-organised collaborative activities when SRL and SSRL are combined, increasing task understanding (Zimmerman, 2002; Hadwin et al., 2016; Järvelä & Hadwin, 2013). Lastly, by encouraging the sharing of viewpoints and the

collaborative creation of new knowledge, SRL and SSRL also aid in the production of communal knowledge (Kreijns et al., 2003; Zimmerman, 2002).

However, many learners lack SSRL skills and struggle to develop them while working on complex collaborative tasks (Malmberg et al., 2015). According to Hadwin et al. (2016), the process of SSRL demands a lot of effort from learners. Moreover, Winne and Jamieson-Noel (2002) note that inappropriate metacognitive monitoring is mostly to blame for the lack of SSRL skills. Learners' cognitive load is increased by performing work in collaborative situations and gaining the necessary regulating abilities, which negatively impacts the process of SSRL (Van Merriënboer & Kirschner, 2013). As a result, without assistance, learners are unable to complete a task and interact properly within their group.

Successful collaboration necessitates targeted assistance in self-regulatory abilities and techniques, as well as regulation at the group level (Järvelä & Hadwin, 2013; Järvelä et al., 2015). Research found that SSRL is unlikely to emerge without guidance (Hadwin et al., 2010; Winne et al., 2013), highlighting the importance of providing guidance to foster the use of SSRL in collaborative environments (Järvelä et al., 2015). Iiskala et al. (2011) highlight the importance of both self- and social-regulatory mechanisms in understanding collaborative learning processes. Therefore, fostering the development of SRL and SSRL skills, as well as providing guidance and assistance to learners, are critical components for promoting effective collaborative learning.

SSRL tools

To improve collaboration, both SRL and SSRL should be supported (Järvelä & Hadwin, 2013). Each member of the group must control their thought processes, behaviours, and beliefs to effectively collaborate (Winne et al., 2013). Van Merriënboer and Kirschner (2013) suggest the use of second-order scaffolding. Unlike first-order scaffolding, which involves providing direct support and guidance to learners, second-order scaffolding focuses on fostering learners' ability to reflect on their own learning and to develop strategies for self-regulation. This can involve activities like motivating learners to establish goals, monitor their personal development, and reflect on their learning processes (Noroozi et al., 2018). Second-order scaffolding aims to support learners in argumentation competence (i.e., their argumentation knowledge), argumentation behaviour, and attitude towards argumentation (Haro et al., 2019).

Moreover, the creation of technology-supported environments can facilitate SSRL (Järvelä et al., 2015). Therefore, Järvelä et al. (2015) propose three principles to guide the design of such technologies. First, it is important to increase learners' knowledge of their own and other people's learning processes. To support this awareness, tools can disseminate relevant information to individuals or groups about their own and others' learning processes, such as task-related, behavioural, cognitive, or social information (Bodemer & Dehler, 2011; Fransen et al., 2013). Second, the use of tools must encourage learners and others to express their learning processes and ideas externally to encourage interaction and exchange among the group. Moreover, teamwork is crucial for encouraging SSRL in groups because sociability and socioemotional contact require a social place that combines the real and virtual worlds. Social space refers to the web of relationships and social connections among group members that are based on the norms and values of the group (Kreijns et al., 2013). The third principle highlights the instrument's role in the acquisition and activation of regulatory processes. Planning, monitoring, and assessment should be promoted, and cognitive, motivating, and emotional interventions should be used (e.g., Dignath & Büttner, 2008). Technology aids can enhance all stages of controlled learning, including task understanding, planning, strategic action, and motivation regulation (Fransen et al., 2011; Järvelä & Hadwin, 2013; Winne & Hadwin, 1998). In collaborative learning processes, the production of metacognitive, meta motivational, and metaemotional knowledge is essential since it aids in monitoring progress and creating effective and efficient working methods. SSRL should place more emphasis on collaborative and learning processes than on the accomplishment of domain tasks (Järvelä et al., 2015).

Building upon this, Järvelä et al. (2016a) summarise several tools that prompt learners to reflect on and negotiate SSRL processes. They concentrate on awareness tools, which are self-regulatory tools that make self-regulation aims visible to group members and expand opportunities for developing socially shared regulation techniques (Järvelä et al., 2016a). Two of these tools focus on the planning process in SSRL. The Individual Planning Tool (IPT) and Shared Planning Tool (SPT) are two planning tools that have been created by Miller et al. (2013) and Hadwin et al. (2013), respectively. The IPT and SPT help manage cognition, behaviour, motivation, and emotions by stimulating the planning and reflection processes (Järvelä et al., 2016a). The IPT encourages learners to plan for a collaborative task on their own. It supports SRL by providing learners with a visual representation of their learning

process and progress, which encourages metacognitive awareness and reflection. Additionally, the tool provides scaffolding for learners by prompting them to consider their motivation, goal setting, and learning strategies (Miller et al., 2013). On the other hand, the SPT encourages a group to negotiate shared task perceptions, goals, and plans (Hadwin et al., 2013). This tool promotes collaborative connections between learners and group members, creating insightful conversations and exchanges that support group regulation (Hadwin et al., 2013). The IPT and SPT provide compelling reasons for their combined use in fostering effective collaboration and SSRL. By leveraging both individual and collective perspectives, this combined approach promotes a comprehensive approach to SSRL. Implementing the IPT and SPT together offers a comprehensive framework that addresses both individual and collective aspects of regulation, facilitating the development of metacognitive and collaborative skills in learners (Hadwin et al., 2013; Miller et al., 2013).

The level of support given by the IPT and SPT can be altered according to the target group. In the low-support version, learners are given open-ended questions, while in the high-support version, they need to pick an answer from a list. The tools were initially created to encourage learners and groups to form task perceptions, but they also hold great promise for helping learners and groups build the abilities needed to control collaboration (Miller & Hadwin, 2015).

Current Study

The current study aims to evaluate the extent to which SSRL is stimulated by using the IPT and SPT in a collaborative context. The IPT and SPT are tools developed to facilitate SSRL. It could be argued that the IPT and SPT together meet the three principles of the SSRL tools of Järvelä and Hadwin (2013). Firstly, the tool should create awareness of one's own and others' learning processes. By answering the questions provided in the IPT, the learner first becomes aware of their learning process. After which, the group learning processes will be discussed during the SPT. Second, learners are encouraged to discuss their individual answers with the group, meeting the principle of externalising individual and group learning processes. Lastly, both tools prompt the learners to plan, which is a regulatory process and thus meets the last principle. It can be concluded that the tools alone are not able to meet all three principles. Therefore, it seems that both tools should be used together.

Since learners often fail to use SSRL skills, it is interesting to evaluate tools that foster SSRL. Therefore, this study focuses on the research question: *"To what extent does SSRL take place when using the IPT and SPT?"* The tools used in the current research are believed to make it easier for learners to externalise their learning processes and potentially help learners and groups develop the skills needed to regulate their group processes. The IPT and SPT together are, thus, expected to promote learners' usage of SSRL skills. Consequently, it is hypothesised that an average to high level of SSRL will be demonstrated by the participants during the collaborative activity.

To answer the research question, the learners will be observed in groups (i.e., audio will be recorded to code their conversations). Subsequently, the extent to which SSRL skills are used can be derived from the coded dialogues. All learners will use the IPT and SPT, which are implemented at the beginning of the group project. Planning and reflection processes are expected to be triggered by the IPT and SPT, which serve as a foundation for regulating cognition, behaviour, motivation, and emotions (Järvelä et al., 2016a). In this sense, the learners are supported to use SSRL skills from the beginning of the project. In addition, the IPT and SPT could provide valuable insights into learners' intentions to use SSRL in their collaborative process. Lastly, it is interesting to see how collaboration proceeds over the other lessons. This can help to determine whether the collaboration and regulation of learning strategies used during the lesson have had a lasting impact on the participants' learning outcomes or whether they were just momentary or situational factors. By using the Team Flow

Monitor (TFM) of Van den Hout et al. (2019), learners can reflect on the collaborative process. This monitor measures team flow, which may provide valuable information about crucial factors that facilitate SSRL.

Furthermore, the difference between the learner's self-regulation and their socially shared regulation in the group is investigated. Therefore, this observational study additionally aims to answer the research question, "*What is the relationship between the SRL and SSRL of learners?*" It is hypothesised that SRL is positively related to SSRL. Winne et al. (2013) argue that advanced SRL skills are required for SSRL to fully emerge, which is supported by research findings showing that SRL predicts social regulation (Grau & Whitebread, 2012; Panadero & Järvelä, 2015). In addition, groups with better individual self-regulators displayed higher levels of group regulation (Panadero et al., 2015). Since the SSRL skills are yet to be measured with the first research question by coding the IPT, SPT, dialogues, and TFM, the SRL still needs to be measured. Therefore, the learners fill out the SRSI-SR, which measures individual self-regulation. With both outcomes, the relationship between the two skills can be assessed.

Methods

Participants

The research was conducted at a secondary school in a small city in the east of the Netherlands. Participants were gathered through convenience sampling. The participants were learners in preparatory vocational education. They participated in an extracurricular programme to support their career goals and gain admission to applied universities.

In total, 40 learners participated in this research (i.e., 22 males and 18 females). The average age was 15.4 (*SD* = 0.55), with the youngest participant being 15 and the oldest participant being 17. The participants worked in groups of six to seven learners, which resulted in a total of six groups. Participants were provided with the option of choosing their top three most interesting topics. They could select from six topics: 3D printing, app development, drones, marketing and communication, podium techniques, and virtual reality. The teachers then tried to divide the participants into groups while considering their preferences. In advance, the participants and their parents gave consent for their participation in this study by signing a consent form. Each participant completed the IPT and SPT at the beginning of the project. To study the SRL, the participants filled out the SRSI-SR. Lastly, to see how the SSRL in the groups proceeded, participants completed the TMF after eight weeks.

Materials

Collaboration Project and Context

The learners in this study followed an extracurricular programme called TopTraject. TopTraject assists learners in preparatory vocational education who aim to earn an applied university diploma. During several projects, learners acquire skills that are required for applied university, such as study skills, language skills, and mathematical skills (TopTraject, 2022).

In the current project, learners were asked to organise a party for the lower grades of secondary education at their school. To do so, the teachers offered subtasks related to different topics, namely 3D printing, app development, drone usage, marketing and communication, podium techniques, and virtual reality. Each group selected one of the topics. This group was then responsible for all issues related to this task; for example, one of the organised activities during the party was a drone race; this activity was fully prepared by the drone group, which also executed the activity during the event. The tasks were

complementary, and therefore, by completing all the subtasks, a well-prepared and varied party was organised. Due to the variety of subtasks, learning goals varied across teams. Nevertheless, the primary goal was to organise a party and learn to communicate and collaborate. Within groups, participants had to collaborate to promote and organise their specific topic. Moreover, team captains were chosen to communicate between groups. To learn more about the topics, the participants received booklets with several exercises. These exercises taught them to understand their specific task and helped them apply the learned content to the actual preparation and organisation of the party.

Go-Lab

To deliver the questionnaire (the SRSI-SR) and SSRL tools (the IPT and SPT) to the participants, the online platform Go-Lab was used. The Go-Lab online authoring environment, known as Graasp (https://graasp.eu/), assists teachers in creating inquiry learning environments for a particular context (De Jong, 2015). In the current study, Go-Lab was used to establish an online environment where participants could complete the questionnaire and use the SSRL tools while collaborating. For this last matter, Go-Lab offers several collaboration applications. Groups of participants can use particular environments and labs together with the collaboration application. This included being able to see in real-time what the other participants were doing with their mice.

Measures

Self-Regulation Strategy Inventory – Self-Report (SRSI-SR).

To measure the levels of SRL of individual participants, the Self-Regulation Strategy Inventory – Self-Report (SRSI-SR) questionnaire created by Zimmerman and Martinez-Pons (1988) and adapted by Cleary (2006) was used. The 28-item questionnaire assessed various self-regulation strategies. The items were rated on a 7-point Likert scale, indicating how frequently they do something (1 = never, to 7 = always). More specifically, participants were asked to rate how frequently they engaged in each of the actions listed in the items when preparing for an exam. A higher score on the SRSI-SR indicated a higher level of self-regulation. Appendix A contains the full questionnaire.

The questionnaire consisted of three subscales: managing environment and behaviour, seeking and learning information, and maladaptive regulatory behaviour. The first

subscale consisted of twelve items on managing environment and behaviour, for instance, *"I make a schedule to help me organise my study time."* The second subscale, seeking and learning information, consisted of eight items, such as *"I look over my homework assignments if I don't understand something."* The last subscale targeted maladaptive regulation behaviours with eight items. For example, one of these items is *"I look over my homework assignments if I don't understand something.*" In this case, low scores were indicative of the application of self-regulation techniques; therefore, these items were rated in reverse. The SRSI-SR showed excellent internal reliability ($\alpha = .91$) in this study.

Individual Planning Tool (IPT) and Shared Planning Tool (SPT).

The Individual Planning Tool (IPT; by Miller et al., 2013) consisted of two questions that prompted the learners to actively construct personal task perceptions. These questions, i.e., "What is the assignment my group and I will be executing during this project?" and "Which steps should we perform to achieve the goal of this project?" asked for explicit and implicit task features, respectively. Lastly, participants were asked what they thought they could learn individually from this project. The Shared Planning Tool (SPT; by Hadwin et al., 2013) included identical questions as the IPT but prompted the learners to share and negotiate their individual responses. Learners were then expected to co-construct a single response to the questions that all group members agreed on. Moreover, they were asked to explain how the given answers were formulated. The IPT and SPT can be seen in Figures 1 and 2.

Figure 1

The IPT as Based on Miller and Hadwin (2015)

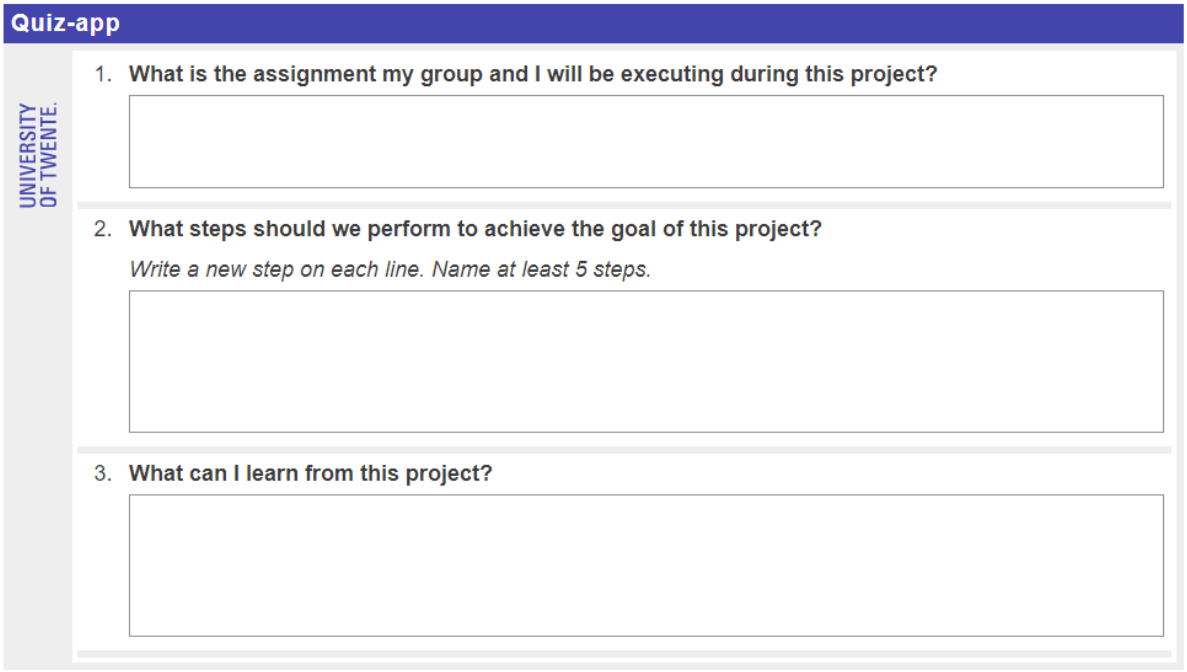
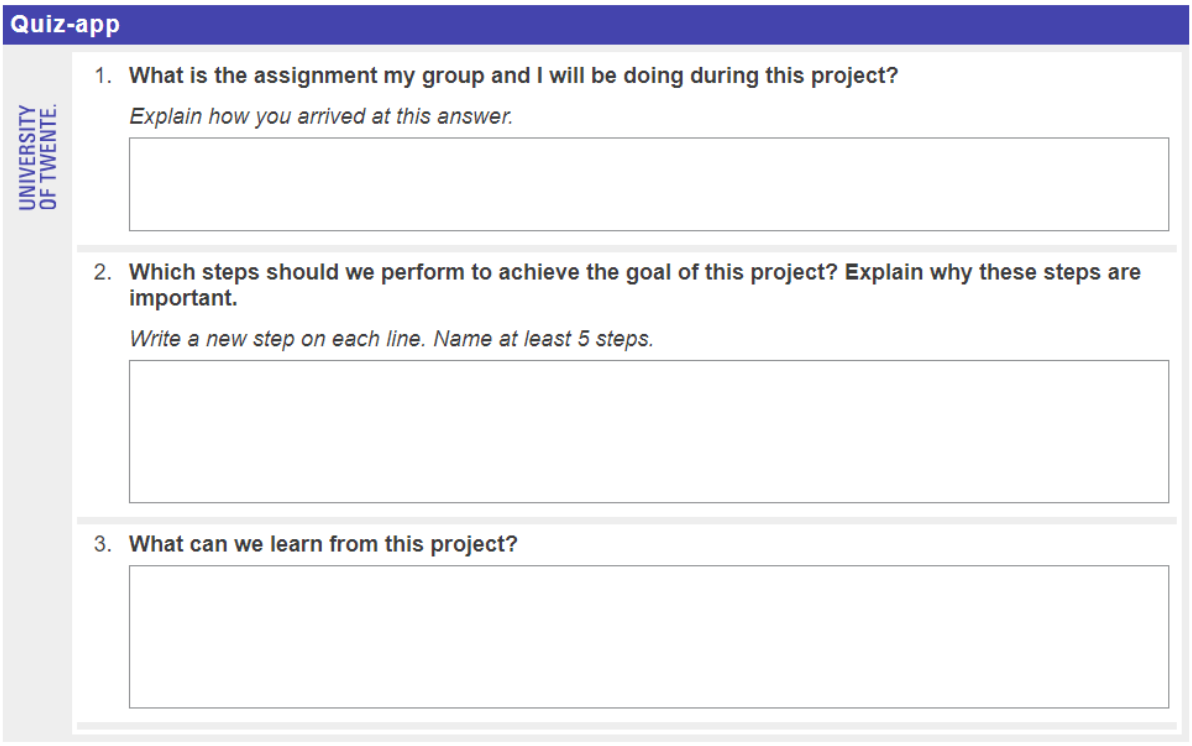


Figure 2

The SPT as Based on Miller and Hadwin (2015)



Team Flow Monitor (TFM).

To assess the level of development of SSRL during the project, the Team Flow Monitor (TFM) was used. This monitor was designed to conceptualise and understand team flow (Van den Hout et al., 2019). There are numerous ways in which the TFM and SSRL are related. The tool's primary purpose is to assess team effectiveness in terms of factors including a common vision, shared trust, defined goals, and feedback (Van den Hout et al., 2019). These are all essential components of SSRL since they entail team members cooperating to establish objectives, track results, and give constructive criticism to one another. For instance, shared and personal goals overlap with goal setting in SSRL. In addition, safety is related to disrespect in SSRL. Van den Hout et al. (2019) define safety as "the level of psychological safety needed to engage in action" (p. 23), whereas Hogenkamp et al. (2021) define disrespect as "making negative comments about group members or bullying or annoying them" (p. 10). In this sense, showing disrespect during collaboration causes a low perceived level of safety. Once the conditions are met, team flow, which consists of feelings of cohesion, progress towards a common goal, mutual trust, and a global perspective, becomes apparent (Van den Hout et al., 2019).

The TFM originally consisted of two parts, namely, the prerequisites of team flow and the characteristics of team flow. According to Van den Hout et al. (2019), team flow begins with the creation of a shared ambition, from which the team builds the other six conditions of team flow, namely: shared goals, personal goals that are linked with those shared goals, high skill integration, open communication, safety, and mutual commitment. Since the conditions related to prerequisites of team flow overlap with SSRL, the items measuring this concept were included in the current research. The questionnaire used in the current research included seven subscales with a total of 23 items from the original Team Flow Monitor. The first subscale, collective ambition, consisted of three items (e.g., *"In the team in which I participate, we share the same ambition."*). The common goal subscale included three items, such as *"In the team in which I participate, we agree on clear goals."* Aligned personal goals consisted of four items, for instance, *"In the team in which I participate, we are stimulated to determine a personal goal."* The fourth subscale, high skill integration, consisted of three items, for example, *"In the team in which I participate, we make use of each other's skills."* The open communication subscale and mutual commitment subscale, both included three items; examples are *"In the team in which I participate, everyone receives clear feedback"* and *"In the team in which I participate, we concentrate on smooth collaboration."* Lastly, four items made

up the safety subscale, for instance, *"In the team in which I participate, there is a positive climate in which to perform."* Appendix B contains the full questionnaire. The items were rated on a 7-point Likert scale, measuring participants' agreement. Answers ranged from 1 ("strongly disagree") to 7 ("strongly agree"). A higher score indicated a higher level of team flow. The questionnaire that was used in this study showed good internal reliability, with α = .90.

Procedure

The current study consisted of two meetings. The first meeting, during which a lesson was observed, took 60 minutes. The second meeting took 15 minutes. At the beginning of the first meeting, the learners were gathered in the classroom for the start of the project. The teachers were introduced, and the groups were divided. The groups first received a brief introduction to the project, and booklets with exercises were provided. Following this 15-minute introduction, groups were seated at tables in various classroom corners to avoid interfering with one another. Each group had 45 minutes to work on both the collaboration tools and their project. The current research was introduced to each group, and the participants were asked to log into Graasp. Firstly, they filled in the SRSI-SR, which took about 5 minutes. When finished, participants could move on with the IPT individually. When every member of the group was finished, a teacher instructed them to discuss their answers and complete the SPT. Participants discussed the SPT through face-to-face communication and completed the SPT together. Using the IPT and SPT took participants approximately 10 minutes. Afterwards, the participants started working on their booklets, which included exercises teaching them about their specific topic. Participants were instructed to collaborate to complete the exercises and communicate through face-to-face communication. The 45 minutes that were recorded entailed their dialogues from the beginning of the group work, including the discussion for the SPT, and the discussion during the group work until the end of the lesson. The second meeting took place eight weeks later, at the end of the lesson. Participants were gathered to complete the TFM. The TFM was handed out on paper. Filling in the TFM took participants approximately 10 minutes, after which they were thanked for their participation.

Data Analysis

Dialogue Coding

The dialogues between participants were recorded and coded to assess SSRL skills in collaborative learning. The codes showed which SSRL skills were shown, and the frequency of codes showed the extent to which participants used SSRL in collaboration. Following the recording of participant interaction, the data was separated into segments. Each segment, which represented one participant's turn to talk, began when a participant spoke and ended when another participant spoke, the participant was interrupted, or there was a pause of more than two seconds The focused coding system, which was built based on the theoretical model of SSRL developed by Hogenkamp et al. (2021), was utilised to code the audio recordings (see Table 1). This led to the identification of sixteen codes that fell into the four categories of SSRL: metacognition, cognition, behaviour, and motivation.

To measure inter-rater reliability, a second coder coded the script of the dialogues between participants. An almost perfect inter-rater reliability was measured, with a Cohen's κ of 0.938. The dialogues included a total of 1236 segments. However, segments that were found irrelevant by both coders were left out of the analysis, leaving 1198 segments. Irrelevant segments were segments that included conversations that were not focused on the project or collaboration.

Statistical Analyses

To investigate the relationship between the variables in our study, we conducted multiple correlation analyses. Firstly, we examined the relationship between the SSRL and the evaluated SSRL after eight weeks to gain a deeper understanding of the SSRL. Next, to answer our second research question, which focused on the relationship between SRL and SSRL, we computed the correlation between the SRSI-SR and the measures of the IPT, SPT, the combined tools, and SSRL in the dialogues.

Table 1

Coding scheme by Hogenkamp et al. (2021)

	Code	Description
Metacognition		
Planning	Goal setting	Setting up or discussing goals for the task
	Task planning	Arranging what action, not specifically assigned to a specific person, needs to be performed at a certain point of time
	Coordinating collaboration	Arranging task division
Monitoring	Monitoring task progress	Checking progress on the task
	Monitoring task performance	Monitoring how well the group is doing regarding the task
	Monitoring comprehension	Checking whether the group understands task-related comments or information
	Monitoring task perceptions	Discussing the difficulty of or attitude towards the task
	Monitoring group performance	Monitoring how well the group is doing regarding collaborative aspects
Evaluating	Evaluating task outcome	Evaluating the outcome of the task
Cognition	Learning strategies	Setting up or discussing learning strategies for the task
	Verifying	Asking group members if provided information is correct
Behaviour	Inclusion	Encouraging involvement of group members by asking for ideas and involving them in the task
	Disrespect	Making negative comments about group members or bullying or annoying them
	Correcting behaviour	Controlling the behaviour of group members
Motivation	Stimulating task focus	Stimulating group members to work on the task when group members disengage from the task
	Praising	Making positive statements about someone's ideas

Results

This study aimed to investigate the extent to which SSRL occurs in a collaborative setting while using SSRL tools such as the Individual Planning Tool (IPT) and Shared Planning Tool (SPT). Additionally, the relationship between socially shared regulation of learning (SSRL) and self-regulation of learning (SRL) was assessed. To address the initial research question, *"To what extent does SSRL occur when utilising the IPT and SPT?"*, a lesson was observed and recorded. The conversations that were recorded for this lesson were coded, similar to the IPT and SPT that the participants completed. The frequency of coded segments linked to SSRL skills in the group project was determined using the coding scheme of Hogenkamp et al. (2021).

Occurrence of Socially Shared Regulation of Learning

The first research question assesses the extent to which learners portray SSRL. The dialogues of the participants were coded, with which SSRL was measured. SSRL was measured by the number of times a skill associated with SSRL was mentioned. The descriptive analysis revealed that the participants showed SSRL skills on average once during a 45-minute class (M = 1.05), which could be considered quite low. The recorded dialogues consisted of 1198 segments, of which 43 were coded as SSRL, indicating that only three per cent of the dialogues included socially shared regulation behaviour.

Groups varied in the frequency of SSRL skills; one group portrayed SSRL on average three times during the lesson (M = 2.67, SD = 2.42), while another group did not show SSRL (M = 0.00, SD = 0.00). In general, participants mostly monitored their task progress, which was marked by questions such as *“Did we answer all questions?”* Table 4 shows how often each code was found, indicating the extent to which SSRL skills were used by the participants, while Table 5 shows the SSRL per project group.

Table 2

Coded SSRL Skills in Collaborative Dialogues

	Code	*n*	Quote
Metacognition			
Planning	Goal setting	4	"We should write down all our ideas."
	Task planning	0	
	Coordinating collaboration	7	"Your job as a team captain is keeping track of how things are going."
Monitoring	Monitoring task progress	9	"Did we answer all questions?"
	Monitoring task performance	0	
	Monitoring comprehension	1	"How did you make a mistake with the coding?"
	Monitoring task perceptions	0	
	Monitoring group performance	0	
Evaluating	Evaluating task outcome	0	
Cognition	Learning strategies	1	"We should write down these ideas we pitch."
	Verifying	3	"Is this the end goal?"
Behaviour	Inclusion	0	
	Disrespect	3	"You are very lazy!"
	Correcting behaviour	6	"I cannot communicate with you like this."
Motivation	Stimulating task focus	3	"Shall we fill in these steps together?"
	Praising	5	"Look! We work together well."

Table 3

Average SSRL per Project Group

Project group	*M*	*n*	*SD*
3D	0.40	5	0.55
App	0.17	6	0.41
Drones	0.00	6	0.00
Light and sound	2.67	6	2.42
Marketing and communication	0.82	11	1.40
VR	2.33	6	2.50
Total	1.05	40	1.77

Use of the IPT and SPT

The IPT and SPT were coded as well since they gave insights on whether participants were planning to use SSRL in their collaborative project. The first question of the IPT was, "*What is the exercise my group and I are going to perform during this project*?" The answers to this question varied between the general project goal, namely organising a party for the lower classes, and the goals for each project group, e.g., developing an app. Comparable results were found for this question in the SPT, with none showing SSRL. The next question of the IPT and SPT was, "*Which steps should we perform to reach the goal of this project?"* None of the participants dove deeper into their material. The answers given included planning, collaborating, discussing, reading the material, producing ideas, executing the plan, organising the party, and presenting. Ten participants mentioned task planning as part of the steps, indicating that they intend to plan their project. Additionally, eight participants intended to divide the tasks among the group. Participants who mentioned coordinating collaboration also mentioned task planning. Approximately a quarter of the participants intended to use SSRL during collaboration. In the SPT, the groups mentioned planning, collaborating, dividing the task, executing, and presenting as steps as well. Two out of six groups, thus, intended to use SSRL during their collaborative process. The last question of the IPT and SPT included *"What can I learn from this project?"* and targeted individual goals. In both the IPT and SPT, this question was answered by using their project topic, e.g., flying drones. Tables 4 and 5 show the presence and frequency of SSRL skills that were mentioned in the IPT and SPT, respectively.

Table 4

SSRL skills mentioned in the IPT

	Code	*n*	Quote
Planning	Task planning	10	"Planning" "Discuss what we want to do and how." "Discuss how we reach the goal." "Roadmap."
	Coordinating collaboration	8	"Task division." "Discuss who will do what."
Monitoring	Monitoring task progress	1	"If you're ready, check whether everything is finished."

Table 5

SSRL skills mentioned in the SPT

	Code	*n*	Quote
Planning	Task planning	2	"Making a planning"
	Coordinating collaboration	2	"Task division."

Team Flow

Lastly, the Team Flow Monitor (TMF) was used to evaluate the development of SSRL during eight weeks of collaboration. On average, the participants scored 5.62 (*SD* = 0.61) on the TFM, indicating good team flow and SSRL. The group working on Light and Sound had the highest average (*M* = 6.21), while the groups working on VR (*M* = 5.78) and Marketing and Communication (*M* = 5.77) had comparable averages. The averages for the teams working on 3D, apps, and drones were lower than the norm. Also, as evidenced by the minor standard deviations, the scores of the individuals in each group are near the group mean (see Table 6).

A correlation analysis was performed between the TFM, the dialogues, and the SRSI-SR. The correlation analysis between the SSRL and TFM showed an insignificant correlation ($r(34) = .24$, $p = .151$), suggesting that the SSRL measured during the observation and the SSRL measured by the TFM are not related. Furthermore, the SRSI-SR was insignificantly correlated to the TFM as well ($r(22) = .14$, $p = .515$).

Table 6

Team Flow per Project Group

Group	*M*	*n*	*SD*
3D	5.08	5	0.65
App	4.87	5	0.65
Drones	5.82	6	0.41
Light and sound	6.21	5	0.18
Marketing and communication	5.77	11	0.42
VR	5.78	4	0.32
Total	5.62	36	0.61

Self-Regulation of Learning in Relation to Socially Shared Regulation of Learning

To assess the second research question, the Self-Regulation Strategy Inventory – Self Report (SRSI-SR) was completed to measure SRL. On average, participants scored 4.69 (*SD* = 0.802) on the SRSI-SR, indicating an average level of self-regulation. A correlation analysis was conducted to investigate the relationship between the IPT, SPT, the combined tools, the SSRL in the dialogues, the TFM, and the SRSI-SR. The normality of the variables was evaluated, after which it was concluded that the SRSI-SR was normally distributed, while the IPT, SPT, the combined tools, dialogues, and TFM were not. Therefore, a non-parametric test was executed, and Spearman's rho was computed. The results revealed a strong positive relationship between the IPT and SPT ($r(38) = .35$, $p = .029$), suggesting that the participants' SSRL skills were consistent across the tools. Next, the tools combined were positively correlated to the SRL in the SRSI-SR ($r(24) = .40$, $p = .045$), indicating that the combined usage of IPT and SPT allows learners to benefit from SRL. Additionally, a strong negative correlation between the SPT and SSRL in the dialogues was found ($r(38) = -.54$, $p = <.001$). Moreover, the combined tools are strongly negatively correlated to the SSRL in the dialogues, with $r = .50$, $p = .001$, which suggests that if SSRL-related answers in the tools decrease, SSRL-related comments in the dialogues increase, and vice versa. Finally, a significant positive correlation between SRL and SPT ($r(24) = .47$, p = .016) suggests a relationship between the participants' SSRL abilities as used in the SPT and their capacity for self-regulation.

Table 7

Spearman's Rho Correlations between the SRL and SSRL Variables

Variable	*n*	*M*	SD	1	2	3	4	5	6
1. SRL	26	4.69	0.802	—					
2. IPT	40	0.47	0.847	.20*	—				
3. SPT	40	0.78	0.698	.47**	.35**	—			
4. Tools	40	1.25	1.235	.40**	.77***	.86***	—		
5. Dialogues	40	1.05	1.768	.10*	-.25*	-.54***	-.50**	—	
6. TFM	36	5.62	0.610	.14*	-.05*	.06*	-.07**	.24*	—

*$p > .05$, **$p < .05$, *** $p < .001$

Discussion

The current study aimed to investigate to what extent socially shared regulation (SSRL) is manifested while using SSRL tools in a collaborative environment. SSRL was measured through coding dialogues and answers to the Individual Planning Tool (IPT) and Shared Planning Tool (SPT). Results show a low level of SSRL during collaboration. However, the Team Flow Monitor (TFM) showed a satisfactory level of group processes. Second, the relationship between socially shared regulation (SSRL) and self-regulation (SRL) in learners was explored. SRL was measured with the Self-Regulation Strategy Inventory - Self Report (SRSI-SR) and showed that the participants had an average level of SRL. Nonetheless, no relationship was found between SSRL and SRL.

Occurrence of Socially Shared Regulation of Learning

In this observational study, the dialogues of participants were recorded and coded. To measure SSRL, the scheme developed by Hogenkamp et al. (2021) was used. It was found that hardly any SSRL took place during the observed lesson. Only three per cent of the conversation included SSRL. The IPT and SPT were created to help learners collaborate and improve their learning through SSRL. However, the current study suggests that using the IPT and SPT does not ensure a high level of SSRL.

The current study did not produce high levels of SSRL, which is consistent with earlier research that suggests that students commonly struggle to properly regulate their learning processes (Järvelä et al., 2015). Learners find SSRL challenging for a variety of reasons. The coordination of various viewpoints and understandings among group members is necessary for SSRL, which can be difficult (Järvelä et al., 2015). Second, SSRL calls for the capacity to monitor and modify both one's own behaviour and that of others (Schellens & Valcke, 2005). High levels of interpersonal and metacognitive awareness are necessary for this. Moreover, learners who lack experience in these areas may find it challenging to negotiate and communicate in social settings (Dillenbourg et al., 1999). Considering these challenges associated with SSRL, it is plausible that similar difficulties could have been present in the current study. Therefore, as suggested by the existing literature, the low levels of reported SSRL may reflect learners' challenges with successfully managing their learning processes and using suitable SSRL techniques.

Additionally, there were variations in the SSRL levels seen among the groups. During the lesson, one group showed SSRL on average three times, whereas another group did not show SSRL at all. According to studies, how much SSRL occurs within the group can depend on the kinds of learning tasks and activities used in collaborative learning. For instance, tasks that are too simple may not need a sufficient level of SSRL and may not motivate group members to participate and work together. Winne and Hadwin (1998) looked at the impact of task complexity on SSRL in a computer-supported collaborative learning setting. They discovered that teams working on complex topics required more SSRL than teams working on easier topics. The participants in the current study collaborated in groups to work on diverse topics. The complexity and difficulty of the topics may have varied. Subsequently, each topic could have required a different level of SSRL.

Use of the IPT and SPT

Even though the IPT and SPT were implemented to support learners in using SSRL, it appeared that the combined tools were ineffective since a low level of SSRL was measured. Only a quarter of the participants intended to use SSRL in their collaboration, and within the six groups, only two groups discussed the use of SSRL as a collective.

An explanation for the lack of SSRL could be that the tools lacked guidance on how to use them. Before the study took place, the level of explanation and guidance for the tools was discussed with the teachers of the concerned group. They mentioned that the participants did not need any guidance and that the participants would understand the tools in their original form. Subsequently, no extra guidance was provided before or during the use of the tools. Nonetheless, it was noticeable that participants had difficulties completing the tools. Group members discussed the usage of the tools often during the collaboration, marked by questions like “How should we continue?” or “Where did you find the next step?” Literature has highlighted the importance of guidance in promoting effective collaboration. Fischer et al. (2013) and Järvelä and Hadwin (2013) have shown that guidance plays a crucial role in supporting learners' collaboration. Furthermore, Miller and Hadwin (2015) found that in order for groups to develop precise task perceptions, leverage each other's task interpretations, and actively negotiate shared task understanding, a high level of guidance in the tools is necessary. Effective guidance would involve providing explicit instructions on how to navigate and use the IPT and SPT, as well as strategies for employing SSRL strategies effectively. Providing

learners with better instructions on how to use the tools can improve productive social interaction (Koschmann, 1996). Also included in the guidance might be examples of SSRL in use, prompts or templates for starting and maintaining SSRL processes, and continuing support and feedback as the tool is used. By incorporating comprehensive guidance into the IPT and SPT, learners would have been better equipped to understand the tools' functionalities and apply them effectively to enhance SSRL. This would promote a deeper understanding of collaborative learning processes, facilitate effective communication and coordination among learners, and optimise the overall learning outcomes.

Lastly, the lack of SSRL can also be caused by participants being more interested in adopting individualistic learning strategies rather than collaborating with others to control their learning (Panadero & Järvelä, 2015). For instance, the achievement of individual learning objectives or finishing individual duties may be more important to learners than contributing to the group's common objectives. Because learners emphasise their own interests over the goals of the group, this individualistic attitude may result in low participation in SSRL procedures. Moreover, in the IPT, which was completed individually, three codes could be found: task planning, coordinating collaboration, and monitoring task progress. No group mentioned monitoring task progress when completing the SPT, which was not discussed either.

Team Flow

The Team Flow Monitor (TFM) developed by Van den Hout et al. (2019) aims to evaluate team flow by considering factors that are integral to socially shared regulation of learning (SSRL). While the TFM does not directly measure SSRL, it provides valuable insights into the overall team dynamics and constructive collaboration (Van den Hout et al., 2019). Recognising the importance of SSRL in optimising team dynamics and collaborative learning environments, the integration of both team flow and SSRL becomes essential.

The TFM results show a satisfactory level of team flow, which means that the team experienced a condition of optimal collective involvement throughout the collaborative activity. This result is consistent with earlier studies that highlighted the benefits of team flow, such as enhanced creativity, productivity, and satisfaction (Sawyer, 2007). The participants may have experienced a keen sense of task proficiency, mutual support, and shared commitment to the project, contributing to their satisfactory level of team flow.

The lack of SSRL that was seen during the collaboration, however, raises questions about the underlying mechanisms and variables affecting the team's collaborative dynamics. The absence of SSRL suggests the possibility that team members' learning techniques were poorly coordinated, leading to a lack of sharing and regulation of cognitive and metacognitive processes. The difference between team flow and SSRL could mean that even while the team was in a higher state of optimal collective engagement, the individual, and collaborative learning processes were not properly synchronised and harnessed.

The difference between team flow and SSRL that has been observed could be caused by several factors. Firstly, the team may rely less on collaborative regulation if there are talented team members who can independently manage their learning processes (Järvelä et al., 2016b). Such independence may prevent the creation of collaborative strategies and social interaction in regulation. Second, the team's decision to focus on SSRL may have been impacted by contextual factors like work characteristics or time limitations. Team members may have given individual contributions priority over SSRL activities if the project had a predetermined framework and few possibilities for collaborative decision-making (Volet et al., 2013).

Self-Regulation of Learning in Relation to Socially Shared Regulation of Learning

Multiple correlation analyses were conducted to assess the relationships between the SRSI-SR, IPT, SPT, combined tools, dialogues, and TFM. First, the positive correlation between the IPT and SPT indicates that the participants' SSRL skills were consistent across both tasks. This consistency in SSRL skills may be due to the fact that the same underlying skills and strategies are transferable across both individual and group planning tasks (Kirschner & van Merriënboer, 2013). Individuals who intend to use SSRL in collaboration are, thus, more likely to discuss with their group members to use SSRL (Hadwin et al., 2011).

Second, the results of this study showed a strong positive relationship between the SPT and SRSI-SR as well. These findings suggest that participants who show higher levels of SRL are more likely to demonstrate SSRL skills while completing the SPT. People who are adept at regulating their individual learning processes may also be more willing to work in a group context and participate in successful SSRL.

Third, negative correlations between the SPT and dialogues and the combined tools and dialogues were found. These negative correlations mean that if, for example, learners

show more SSRL while completing the tools, they tend to show less SSRL in their dialogues. This is not in line with the goal of the tools at hand. The SPT and IPT are both implemented to prompt learners to reflect on and negotiate SSRL processes, meaning one would expect a positive correlation. The negative correlation suggests that there may be a relationship between the use of the SPT and a decrease in SSRL during collaboration. The differences in communication could have accounted for this negative correlation. The IPT and, especially, the SPT expected the participants to communicate via an online tool, whereas the dialogues included the discussions during the lesson. It is noticeable that some participants were quiet and hardly spoke up. Online communication tools, such as the IPT and SPT, may be more effective at fostering SSRL since they give users a stronger sense of anonymity and psychological safety (van Merriënboer & Kirschner, 2013). This factor might contribute to the observed discrepancy in SSRL levels between the tools and the dialogues. Due to the lack of social pressures and hierarchies present in face-to-face interactions, learners may feel more at ease sharing their ideas, opinions, and queries online. This may foster a more welcoming and collaborative learning environment where learners are encouraged to participate and take charge of their education. Therefore, participants may have felt more motivated to contribute to the discussion through the online tools than in the face-to-face communication in the dialogues, which could have led to a negative correlation. Additionally, the negative correlation between the use of the tools and the measured SSRL in the dialogues can indicate that learners tend to rely solely on the written aspects of the tools, neglecting the need for active discussion and engagement with the content. This phenomenon suggests that learners may view the SSRL tools as a checklist or a one-time activity rather than a catalyst for ongoing dialogue and reflection.

To answer the second research question, investigating the relationship between SRL and SSRL, it appears that the level of SRL of participants does not influence the level of SSRL in collaboration, and vice versa, which is not in line with earlier research. Research by Grau and Whitebread (2012) suggests there is a relationship between the SRL and SSRL of learners. Although the participants showed an average level of SRL skills, a low level of SSRL skills was found. Since Winne et al. (2013) indicate that learners require SRL skills to use SSRL skills, it can be concluded that something additional is needed to manifest SSRL. It is possible that effective communication and collaborative problem-solving skills might contribute to portraying SSRL. This is because SSRL is not an individual construct but a collective one that

requires coordination and communication among learners (Järvelä & Hadwin, 2013). Therefore, having the ability to effectively communicate with peers is a crucial skill that learners might need to engage in SSRL. Similarly, learners might need to engage in collaborative problem-solving, which involves working together to generate solutions to complex and ambiguous problems that often arise in collaborative learning environments (Stahl, 2006). Collaborative learning can be challenging and may lead to conflicts and misunderstandings (Hadwin et al., 2011), so learners might need to manage their emotions and reactions in such situations to maintain positive social interactions. This might require emotional regulation, empathy, and social competence (Brackett et al., 2011). While there may be some overlap between SRL and SSRL, they are not necessarily correlated, which could be due to the differing levels of analysis used by SRL and SSRL. SRL is a concept that exists at the individual level, while SSRL takes place at the group or collective level (Hadwin et al., 2011). In other words, one's capacity for SSRL with others may not always be predicted by one's level of SRL, and vice versa. Moreover, there may be differences between the factors that influence SSRL and SRL. For instance, while communication, cooperation, and trust may be more significant determinants of SSRL, motivation, self-efficacy, and self-control may be major predictors of SRL (Hadwin et al., 2011). Additionally, it is important to keep in mind that the relationship between SSRL and SRL may also depend on the environment in which these processes take place. In other circumstances, the collective processes of SSRL may be more substantial for achieving a shared goal, and individuals may be able to use their SRL skills to effectively engage in SSRL with others in some situations (Järvelä & Hadwin, 2013; Zimmerman, 2013).

Additionally, it is possible that the lack of the expected relationship between SRL and SSRL in the current study was due to the different measurements used to assess these constructs. SRL was measured using a self-report measure, while SSRL was measured through observation. Using different instruments to measure SRL and SSRL may have limited the ability to make direct comparisons between the two constructs. While both measures have been shown to be valid and reliable in previous research, it is important to consider the potential limitations of using separate tools to assess related constructs. To date, there has been no single measurement instrument developed that captures both self-regulated learning and socially shared regulation of learning, as these constructs involve distinct cognitive and social processes and are typically measured using separate instruments.

Limitations and Future Research

Several limitations could be discussed while evaluating this study. First, a low level of SSRL was found, even though it was expected that while using the IPT and SPT, participants would show a moderate to high level of SSRL. As discussed, the tools may have lacked support on how to use them. A limitation here could be the low user-friendliness of the tools. Participants filled in the IPT and SPT via mobile phone, which has a different interface than when working on a laptop. The interface on a mobile phone is compact. Subsequently, participants could not see the different tabs or their group as a whole. They could see the others typing; however, participants might have been less aware they could fill in the SPT as a group and contribute equally. Rather than the cognitive processes being used to accomplish instructional goals, the extraneous load is imposed by the cognitive activities that a learner is engaged in because of the way the learning tasks are organised and presented (Sweller et al., 1990; Sweller & Chandler, 1994). The extra steps to find the different tabs of the IPT and SPT can, thus, have caused too much extraneous load. Lastly, participants differed in the speed at which they completed the exercises. These differences were not accounted for by either the group members or the tools used.

Hardly any SSRL was found in the observed collaboration between participants. Moreover, it seems that the use of the SPT lowers SSRL in face-to-face communication. To get a better understanding of the influence of the IPT and SPT on the SSRL in collaboration, it could be interesting to conduct research to evaluate the SPT by using a control group. This gives the opportunity to see the effect of the tools on SSRL. Additionally, since an improvement in SSRL was found in the TFM, a longitudinal study measuring SSRL while using the IPT and SPT can lead to valuable insights into the development of SSRL over time.

The findings of the correlation analysis, which was conducted to answer the second research question, did not reveal the expected significant effects, indicating that such relationships are rarely found in the population. Thus, it might be said that the sample did not meet expectations. Moreover, the participants were gathered through convenience sampling. As mentioned by Babbie (2013), the population is not always accurately represented by convenience sampling. The research included 40 participants as a sample, split up into six groups. The sample may have been biased as a result. The sample size could be a factor in this nonsignificant result. A small sample size may restrict the data's capacity to be generalised.

The less representative the sample is of the wider population from which it was drawn, the smaller it may be. This indicates that results may not be generalizable to a larger population than the particular sample examined, explaining the lack of significant results. A larger sample size might have given more statistical power to identify a significant correlation between SRL and SSRL. Overall, the small sample is a constraint that needs to be acknowledged when interpreting the findings. It could be worthwhile to think about conducting a larger study in the future to solve this constraint and offer more reliable results.

Despite the limitations, the lack of a relationship between SRL and SSRL could indicate that additional skills are needed to manifest SSRL. In particular, research has suggested that emotional regulation, empathy, and social competence could be critical components for manifesting SSRL (Brackett et al., 2011). Future studies may benefit from exploring these additional factors to better understand the complex nature of SSRL and how it can be fostered in educational contexts. Earlier research (e.g., Grau & Whitebread, 2012) did find a relationship between individual and social regulation. A possible relationship between the two variables may be an interesting starting point for future studies. The fact that studies like those by Grau and Whitebread (2012) and Panadero and Järvelä (2015) did discover a significant relationship between SRL and SSRL raises the question of what factors did affect their research and produced their statistically significant conclusions. Panadero and Järvelä (2015) stress the importance of exploring how SRL may influence SSRL (e.g., what additional skills are needed). To gain a more thorough understanding of the relationship between these constructs and their influence on learning outcomes, the creation of a single measure that simultaneously measures SSRL and SRL would be beneficial. This idea should be investigated in more detail in future studies.

Implications

The results of this research have important implications for understanding and enhancing the dynamics of collaborative learning settings. Firstly, comprehensive guidance in the IPT and SPT would better equip learners, enabling them to understand and apply the tools effectively for enhanced SSRL. This includes demonstrating examples, providing prompts, and offering ongoing support. Such guidance promotes understanding, communication, coordination, and optimal learning outcomes. Furthermore, as no correlation was found between the SSRL in the dialogues and SRL, educators should be cautious about assuming that advancing one of

these constructs will inevitably result in advancements in the other. Therefore, while creating instructional activities that support either SRL or SSRL, educators should take the nature of the learning task and the characteristics of the learners into consideration. Additionally, educators must make sure that the methods they employ to evaluate SRL and SSRL are suitable for the particular context and objectives of the learning activity (Panadero & Alonso-Tapia, 2014b). Lastly, understanding the interaction between team flow and SSRL is essential for effective collaborative learning. Team flow enhances motivation and engagement, but without strong SSRL, collaboration's benefits may be limited. Educators should balance promoting team flow and cultivating SSRL through intentional design and shared responsibility (Järvenoja et al., 2013).

Conclusion

The purpose of this study was to examine how often socially shared regulation (SSRL) skills are demonstrated during collaborative learning while utilising SSRL tools, as well as to investigate the relationship between SSRL and learner self-regulation (SRL). Based on the observational research, a low level of SSRL during collaboration was found, with participants typically displaying an SSRL skill just once throughout a 45-minute lesson. It can be concluded that the extent to which SSRL takes place during collaboration is low. This finding is consistent with previous research highlighting the challenges associated with SSRL (Järvelä et al., 2015). Moreover, the effectiveness of tools such as the Individual Planning Tool (IPT) and Shared Planning Tool (SPT) in promoting SSRL may be limited without proper guidance on how to use them. The Team Flow Monitor (TFM) indicated a satisfactory level of team flow, but there seemed to be a discrepancy between the SSRL observed during the lesson and the experienced team flow over the project. In addition, the Individual Planning Tool (IPT) and the Shared Planning Tool (SPT) showed a significant positive correlation through the correlational analysis, showing that learners do discuss their input with fellow group members. Nevertheless, the SPT and dialogues had a high negative correlation, indicating that the use of the SPT does not foster SSRL. This raises the question of whether the use of the IPT and SPT is effective. Finally, there was no correlation between self-reported SRL and observed SSRL. These results imply that to enhance group outcomes in collaborative learning environments, SSRL may need to be actively taught and promoted. Future research should focus on the additional skills that learners need to use SSRL.

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Appendix A: SRSI-SR – Dutch

Lees eerst deze tekst goed voordat je begint met de vragenlijst.

Je gaat zo een vragenlijst maken. Deze vragenlijst gaat over hoe jij werkt als je moet leren voor een toets. Je gaat deze periode een project doen met een groepje, maar nu zijn we benieuwd hoe jij te werk gaat als je een toets alleen maakt.

De vragenlijst begint met een paar algemene vragen. Daarna komen 28 vragen over hoe je werkt als je een project doet.

- Hoe oud ben je?
- In welke klas zit je?
- Wat is je geslacht?
    - Jongen
    - Meisje
    - Anders: _____
    - Zeg ik liever niet.

- Hoe vaak doe jij de volgende dingen in de periode voor een toets? (
    1. Ik zorg ervoor dat niemand me stoort als ik aan het leren ben.
    2. Ik probeer op een rustige plek te leren.
    3. Ik denk na over het soort vragen dat in een toets voor kunnen komen.
    4. Ik vraag mijn docent naar de onderwerpen die in de komende toetsen aan de orde komen.
    5. Ik vertrouw op de aantekeningen van mijn lessen om te leren.
    6. Ik leer hard, ook al zijn er thuis leukere dingen te doen.
    7. Ik maak zelf een quiz om te zien hoeveel ik heb geleerd.
    8. Ik maak een schema om me te helpen mijn studietijd te organiseren.
    9. Ik gebruik mappen om mijn lesmaterialen te ordenen.
    10. Ik verlies makkelijk belangrijke lesmaterialen.

11. Ik ga niet naar extra hulpsessies.
12. Ik wacht tot het laatste moment om te leren voor toetsen.
13. Ik probeer de onderwerpen die ik moeilijk kan leren te vergeten.
14. Ik probeer te zien hoe mijn aantekeningen van de les verband houden met dingen die ik al weet.
15. Ik probeer te bedenken hoe toekomstige toetsen er uit zien.
16. Ik probeer te leren op een plek zonder afleiding (bijvoorbeeld lawaai, pratende mensen).
17. Ik stel mijn docent vragen als ik iets niet begrijp.
18. Ik maak foto's of tekeningen om me te helpen nieuwe onderwerpen te leren.
19. Ik geef het op of stop ermee als ik iets niet begrijp.
20. Ik vergeet mijn lesmaterialen mee naar huis te nemen als ik moet leren.
21. Ik vertel mezelf precies wat ik wil bereiken tijdens het leren.
22. Ik bekijk mijn huiswerkopdrachten als ik iets niet begrijp.
23. Ik vermijd vragen te stellen in de klas over dingen die ik niet begrijp.
24. Ik zeg tegen mezelf dat ik het moet blijven proberen als ik een onderwerp of idee niet kan leren.
25. Ik organiseer mijn lesmateriaal zorgvuldig zodat ik het niet kwijtraak.
26. Ik laat me door mijn vrienden storen als ik aan het leren ben.
27. Ik denk na over hoe ik het beste kan leren voordat ik begin met leren.
28. Ik zorg dat ik klaar ben met leren voordat ik videogames ga spelen of met mijn vrienden afspreek.

Appendix B: Team Flow Monitor – Dutch

Constructs	Items
Collectieve ambitie De mate waarin dezelfde ambitie collectief wordt gedeeld	In onze projectgroep …
	… delen we dezelfde ambitie.
	… vormen we een team vanuit een innerlijke drive om samen dingen te bereiken.
	… vinden we dat deelnemen aan het groepswerk ons zal belonen.
Gemeenschappelijk doel Een collectief doel dat door iedereen wordt onderschreven	In onze projectgroep …
	… onderschrijven wij de gestelde doelen.
	… spreken we duidelijke doelen af.
	… bieden de gezamenlijke doelen een uitdaging.
Op elkaar afgestemde persoonlijke doelen De aanwezigheid van persoonlijke doelen die ook bijdragen aan het gemeenschappelijke doel	In onze projectgroep …
	… worden we gestimuleerd om een persoonlijk doel te bepalen.
	… worden de persoonlijke doelen afgeleid van het gezamenlijke doel.
	… zijne persoonlijke doelen belangrijk voor het hele team.
	… gaan persoonlijke doelen goed samen met die van het team.
Integratie van hoge vaardigheden De rangschikking van individuele verdiensten tot een collectieve kracht	In onze projectgroep …
	… gaat ieder teamlid een passende uitdaging aan.
	… maken we gebruik van elkaars vaardigheden.
	… worden individuele vaardigheden gebruikt voor het gehele team.
Open communicatie Openheid in communicatie met elkaar	In onze projectgroep …
	… krijgen we feedback van elkaar waarmee we verder kunnen.
	… geven we elkaar waar mogelijk feedback.
	… krijgt iedereen duidelijke feedback.
Veiligheid Het niveau van psychologische veiligheid dat nodig is om tot actie over te gaan	In onze projectgroep …
	… voelen we allemaal dat het veilig is om onze taken uit te voeren.
	… is er een veilige sfeer om te leren.
	… voelen we allemaal dat het veilig is om risico's te nemen.
	… is er een positieve sfeer om te presteren.
Wederzijdse inzet De mate van betrokkenheid bij elkaar	In onze projectgroep …
	… letten we op elkaars bezigheden.
	… weten we van elkaar wie wat doet.
	… concentreren we ons op een vlotte samenwerking.