Exploring the strategic potential of roles for collaboration

by

Shayla Starcheski
B.A., University of Nevada, Reno, 2014

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Supervisory Committee

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Abstract

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Collaboration is an important yet difficult skill for learners in the 21st century. Recent research has examined how supports, such as group scripts and roles, can help learners collaborate effectively. However, little is known about the perceptions learners have of these supports when provided to them. The purpose of this study was to examine (a) learner's choices and reasonings for role choices and (b) the impact of group roles. Participants included 111 undergraduate students in a *learning strategies for university success* course. During the course, students completed two required collaborative tasks, including pre-task planning and a post-task reflection. Students made choices regarding roles in individual and group planning sessions and explained their reasoning for making those choices. Students frequently chose roles relating to strategic task enactment, motivation, and concept/domain knowledge in their individual and group planning sessions with their primary reasons being focused on "self" knowledge, or information about themselves, such as strengths or weaknesses. These findings suggest learners may believe these are important roles for collaboration. The reliance on "self" knowledge for making decisions may be attributed to the fact these groups were collaborating for the first and second times and may not have a plethora of group information to utilize. Contributions of this study to theory, research, and practice will be discussed.

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Chapter 1 Introduction

In a world where industries require more globally distributed interactions, learners increasingly need to collaborate both digitally and face-to-face. For this reason, collaboration has been identified as an important skill for the 21st century (Premier's Technology Council of BC, 2010). However, research on collaboration indicates it is a difficult skill to acquire, and true collaboration does not happen by simply grouping learners together (Barron, 2000). The complex nature of collaboration often leads learners to encounter challenges that require specific strategies to overcome. Without support, they may be less successful in using strategies to overcome these challenges (Hadwin, Bakhtiar & Miller, 2017).

For this reason, research needs to examine ways to support and foster students to build skills necessary for collaboration. Current research on supports for collaborative learning has highlighted ways to target skills such as planning (see Miller & Hadwin, 2015) or to supply group roles for learners to utilize (see Strijbos, Martens, Jochems & Broers, 2004). The current descriptive study aims to examine the strategic choices learners make when provided with supports (roles) designed to promote awareness and action surrounding common challenges by analyzing the roles they choose, the reasons they provide for these role choices, and how these roles impact collaboration. This research is a critical next step as providing supports to help learners foster skills for collaboration is not enough without understanding *how* they perceive and utilize them. This research has potential to inform: (a) how educators can strategically make choices about what supports are provided to groups, (b) what information helps to guide learners

to make informed choices about provided supports in collaboration, and (c) how supports can be implemented to foster students' regulation.

Chapter 2 Literature Review

Collaboration

Collaboration is a coordinated, learner-driven activity involving interaction and working collectively towards solving a problem (Roschelle & Teasley, 1995). It is distinct from cooperation as it requires learners to work collectively towards a shared problem, while cooperation often emphasizes coordinated versus joint effort and task division. In collaboration, group members must work together to create a shared knowledge product which is ultimately greater than what one individual could have accomplished (Barron, 2003). Critical to this process is (a) active engagement and coordination among group members and (b) distributed expertise of resources and unshared knowledge within the group (Barron, 2000; 2003). True collaboration is difficult to achieve, and learners often encounter challenging situations throughout the process (Barron, 2000).

Challenges in collaboration. Challenges in collaboration are widespread, and learners may experience a variety of challenges simultaneously. Although each collaborative task presents unique challenges, research highlights many of the common challenges encountered by learners. Challenges are primarily focused in five main categories: motivational, socio-emotional, cognitive, metacognitive, and environmental (Bakhtiar, In Progress). *Motivational challenges* relate the commitment levels to the task, and groups may face challenges relating to interest level or varying goals (Naykki et al., 2014). The most frequent issues leading to motivation challenges are differences in personal priorities for the task or different understandings of teamwork. These types of challenges were often met with strategies focused on social reinforcement or developing

structure for the task (Järvelä & Jarvenoja, 2011). *Socio-emotional challenges* are derived from emotional problems within the group, and include facing challenges such as incompatible working or interaction styles, or having an overall lack of team cohesion (Naykki et al., 2014). Naykki et al. (2014) emphasized the critical nature of both recognizing and responding to socio-emotional challenges in group work. Without this recognition, learners tend to withdraw from the task. *Cognitive challenges* pertain to the cognitive demands required in learning, such as difficulty understanding another learner's use of concepts. These challenges may include reaching shallow levels of knowledge construction when completing their task (Naykki et al., 2014; Winne, 2011). Some current literature uses cognitive and metacognitive interchangeably when describing challenges, however, they refer to different processes and challenges. *Metacognitive challenges* arise from reflection or lack thereof in group processes, such as not evaluating progress or understanding (Naykki et al., 2014). *Environmental challenges* are external to the task itself and are sometimes barriers the group members had no control over. Some environmental challenges reported by learners are task complexity or availability and time constraints, which may limit the group's ability to successfully collaborate (Edmondson & Nembhard, 2009; Fransen et al., 2011).

Due to the variety of challenges learners encounter, recent research has examined ways to ameliorate effects of challenges and support the collaborative process and its outcomes. Naykki et al., (2014) identified the growing knowledge on challenges students encounter as a critical step towards designing and implementing supports to overcome these challenges. Various supports have been examined for providing structure to collaborative learning, including scripting and group roles.

Support for Collaboration

Supports in a collaborative context aim to foster the development of skills, rather than to simply decrease or offload effort required for the collaborative work. Supports have been examined in reference to three key outcomes and processes within collaboration: metacognitive, knowledge construction, and regulation. Metacognitive supports are designed to promote learners' thinking about themselves and the task (see Zion, Adler, & Mevarech, 2015). Supports for knowledge construction prompt and promote higher levels of thinking for a collaborative task (see Weinberger, Ertl, Fischer, & Mandl, 2005). Lastly, supports for regulation promote learners' active involvement in the collaborative process through planning, engagement, making changes and monitoring throughout (see Miller & Hadwin, 2015). Two main supports that have been examined are scripts and roles

Scripting. Scripting provides structure to a given task through prompts and guides (Kollar et al., 2006). Scripting supports learners by specifying, sequencing, or distributing the task components learners need to enact during the collaborative task (Kollar et al., 2006; Dillenbourg, 2002). Collaborative scripts consist of five components: (a) specific objectives, (b) specific activities, (c) sequences for what activities should be completed and when to complete them, (d) distributed roles among learners, and (e) various forms of representation to learners (Kollar et al., 2006). Scripting can also be implemented as macro or micro-scripts, depending on the level of granularity of the given support (Dillenbourg & Hong, 2008). Macro scripts model the sequence of activities learners should complete for a collaborative task, and micro-scripts provide support for the activities learners engage in, and are designed to be internalized over time.

Research on scripts is far-reaching and examines a variety of ways to support learners in collaborative tasks. Current research on scripting has heavily emphasized supporting knowledge construction processes, often through two main types of structuring: epistemic activities and social modes (Weinberger, Ertl, Fischer, & Mandl, 2005). Epistemic scripts support knowledge construction activities, such as providing questions to prompt the learner to think about a concept, whereas social scripts support the interaction of learners, such as sentence starters to prompt negotiation between group members (Weinberger, Ertl, Fischer, & Mandl, 2005).

Research has shown that scripting can increase comprehension and learning. This was seen in early research by Palinscar and Brown (1984), in which face-to-face reading comprehension tasks were scripted through reciprocal teaching by providing structure around what learners should do with given text. Some learners were placed in a reciprocal teaching condition and were provided two roles: discussion leader and student. Findings indicated reciprocal tutoring increased the main idea questions and summaries students provided while decreasing the incorrect/incomplete statements and unnecessarily detailed summaries.

Examining scripting in the context of knowledge construction has shown scripting as a promising support, but that there is a risk of implementing too much scripting. Two studies by Weinberger et al. (2005) examined the effects of epistemic versus social scripts in collaborative learning. The first study examined a group discussion task in which learners developed responses to discussion prompts. Groups were divided amongst four conditions. Learners were provided with: (a) no scripting (control group), (b) epistemic scripts, (c) social scripts and (d) both epistemic and social scripts. The

epistemic script for this study prompted learners to apply theoretical concepts to the discussion thread by having a pre-structured form to guide learners' answers. The social script aimed to foster the processes of negotiation needed to construct knowledge by giving conversation prompts, and utilized two roles, an analyst, and a constructive critic. The epistemic and social script condition contained elements of both scripts – in that the initiating and concluding messages of the analyst were pre-structured with epistemic scripts, and the responses were structured with social scripts. Through the use of a pre- and post-test, findings showed learning was increased with the social script condition, however, the epistemic script condition hindered learning. Findings also revealed learners in the combined scripts condition learned less than those in the control condition. This finding suggests learners can be over-scripted, and finding the correct balance is key to effective use supports for collaborative learning. Furthermore, epistemic scripts may create more of a checklist for learners to follow rather than promoting deeper thinking and skill development.

Weinberger et al. (2007) further applied epistemic and social scripts by examining learners completing a collaborative task with the use of a video conferencing system. Using the same conditions as study 1, groups were assigned to (a) no scripting (control group), (b) epistemic scripts, (c) social scripts and (d) both epistemic and social scripts. The epistemic script in this study provided learners with a table of content-related prompts learners could use to guide their discussion. These prompts stressed important aspects of successfully completing the task. The social script in this study provided learners the role of either tutor or tutee and provided sequencing for the learners' interactions, such as explaining text material (tutor) and asking comprehension questions

(tutee). The combined conditions provided the epistemic prompts and the instructions/role descriptions provided in the social script condition. Similar to the findings in the first study, there was a positive effect of the social script on individual knowledge acquisition, however, there was no effect from the epistemic script. Findings suggest epistemic scripts are not supporting learners in the way they are designed, which may be due to learners' perceptions of the support or not fully utilizing it. Ultimately, this identifies a need to shift towards social scripts to promote collaborative processes and outcomes, rather than supporting the type of thinking associated with a task. There is also a risk of overscripting or providing too much support for learners through employing too many types of support.

While most of the scripting research is focused on supporting knowledge construction, scripting has also been explored in supporting learner's regulation. Regulation of learning is the intentional and purposeful engagement in learning through goal setting and strategy use (Zimmerman, 1990). Miller and Hadwin (2015) explored the impact of using epistemic scripts to support regulation of learning, specifically planning, in a collaborative task. Planning tools contained either low scripting, with more open-ended questions, or high scripting with more directed questions and answers to make choices from. These planning tools were utilized for both individual and group planning sessions and prompted learners to answer several questions pertaining to task understanding and goals. This study employed a 2x2 research design, using either low or high scripting for either planning tool. Findings indicated a high level of group scripting resulted in more accurate task perceptions, but there was no impact on group performance for the task. While these scripts stimulated planning in learners, there is a need to develop

supports that carry through the task and support more than one targeted process or phase of collaboration because the effects of scripting did not increase performance and outcomes in later parts of the task. Furthermore, Miller (2015) emphasized the need to move away from epistemic scripts towards social scripts to support and prompt interactions, rather than scripting the task itself. The current study emphasizes shifting towards more social-driven supports to allow learners to negotiate and enact their roles as necessary, rather than following a formula for enacting their role.

Scripting is a widely used approach to supporting learners, in both collaborative and individual learning situations. While varying types of scripting have been utilized in supporting learners, the findings have been promising. Research on scripting has illuminated a need to not over-script and to shift towards a process-based social scripting approach. This social-focused approach can be matched with promising research on roles to structure collaborative learning.

Group roles. Roles provide a second way of supporting collaborative learning by providing learners with a job identity to uphold throughout a task. Roles provide structure through targeting key aspects and creating identities out of them for learners to enact (Slavin, 1995). Assigning roles in collaborative tasks creates a level of individual accountability, as group members have a specific role they are trying to fulfill (Slavin, 1995). Thus far, empirical research has focused on two types of group roles, functional/procedural roles, and cognitive roles (Palinscar & Herrenkohl, 2002).

Functional roles. Functional roles focus on the "doing" of the task and break a task into specific components, and each component is then assigned as roles. The purpose of functional roles is to support completing a task and are often directed towards the

action needed for a specific task component. Functional roles correspond to different components of a collaborative task, and as such, the aim of these roles varies.

Strijbos et al., (2004) employed four functional roles in a four-person group for a collaborative task. Group members had the opportunity to discuss and assign the roles within their group. The four roles used were (a) project planner, which focused on project planning and monitoring progress, (b) communicator, which focused on contacting the supervisor and giving progress reports, (c) editor, who compiled all input from group members, and (d) data collector, which inventoried current information and sought out additional information when necessary. Findings revealed learners with roles had more communication between them and covered more relevant content (such as task coordination or task content).

In a study utilizing a different set of roles with a scripted role condition and a condition without roles, Schellens et al., (2007) utilized four group roles: (a) source searcher, whose responsibility was to find sources for the task, (b) theoretician, whose responsibility was to ensure appropriate knowledge was used, (c) summarizer, whose responsibility was to summarize conversation and identify disconnect in ideas, and (d) moderator, whose job was to monitor the discussions and pose questions. These roles were implemented in an online discussion forum where only 4 of the 10 group members had a role at any time, and they were assigned by their professor at random. Findings showed that students in this role condition: (a) reached higher levels of knowledge construction in their discussions, (b) ended the course with higher exam scores and (c) performed significantly better if they were in a group given roles, even if they personally were not assigned one.

De Wever et al., (2008; 2009) extended Schellens et al., (2007) by adding an additional fifth role, the starter, whose responsibility was to create several posts at the beginning for the group to build on. Findings indicated that learners in an assigned role fulfilled those scripted responsibilities more than any other person in the group. For example, a learner with the project planning role would do more project planning and monitoring than a person with a different role, or a person without a role.

The purpose of the functional roles in these four studies (De Wever et al., 2008; 2009; Schellens et al., 2007; Strijbos et al., 2004) is to support learners to complete a specific task, such as summarizing or gathering sources, and not to promote collaborative effort. However, research on roles has shown that learners engage more with the task when roles are assigned (De Wever et al., 2008; Schellens et al., 2007; Stribjos et al., 2004). Findings surrounding roles in relation to performance is mixed, as it has shown grades are higher with roles (Schellens et al., 2007) and that roles had no effect (Strijbos et al., 2004).

Cognitive roles. Cognitive roles focus on scaffolding the "thinking" of the collaborative task (O'Donnell, Hmelo-Silver, & Erkens, 2005). Cognitive roles support complex academic tasks by sectioning out types of thinking and processing.

Chou, Lin & Chan (2002) developed a computer-simulated program and proposed it would support reciprocal tutoring, a collaborative exercise where learners alternate between being the tutor or the tutee and cover various tasks. Although the virtual learning companion is limited to two students, and may not be considered collaboration as it is less than three students, this design demonstrates the need for adaptability in collaboration and roles as learners face new challenges.

O'Donnell, Rocklin, Dansereau, Hythecker, and Young (1987) used cognitive roles to examine information memorization. Using two roles, the recaller and the listener, participants were divided amongst three conditions: (a) learners switched roles after the first run-through and summarized all the passage, (b) learners switched roles after the first run-through and summarized only the most recent passage, (c) learners did not switch roles and summarized all the passage. Findings indicated (a) learners who enacted the recaller role for both run-throughs remembered more information than other groups, but it was less accurate and (b) learners who switched roles had more accurate information.

Current usage of roles. Usage of roles in past research has highlighted their potential as a structured strategy in collaboration. Current roles presented in the literature provide ways for learners to structure their learning, ultimately decreasing potential conflict, however, are often structured around divided task components or specific types of thinking. This study extends research on roles by associating roles with frequently encountered challenges and should present learners with a way to actively monitor and ultimately mitigate potential issues in their collaborative process. By designing roles in direct connection to challenges recognized by learners and infusing supports, the occurrence of these challenges will be prompts and opportunities for learners to regulate.

Research to date has tended to focus on roles assigned to learners, rather than roles selected by students to support collaboration. From a self-regulatory perspective, in which learners take control of their motivation, behavior and cognition (Zimmerman, 1989), this takes the control away from the learners and limits the potential of roles being adopted strategically by learners to address challenges they encounter or anticipate. When

learners are assigned roles, or given no choice about roles to use, they are not self-regulating. For example, Strijbos et al. (2004) gave four functional roles to groups of four students, and learners were required to utilize all four roles by assigning them within their group. Schellens et al., (2007) and De Wever et al., (2008; 2009), assigned four or five roles randomly to four or five of the students situated in the larger group of 10 students.

However, these studies did not examine the purpose or intent with which roles were chosen. Understanding the reasoning underlying role choice is critical for optimizing the potential of roles as a strategy employed by learners to optimize collaborative learning and regulation, particularly in situations when challenges are encountered during teamwork. Regulation is about strategic engagement and adaptation during which learners choose, use, and revise strategies to optimize learning and performance in a range of situations and challenges. Purposeful decisions about roles reveals metacognitive awareness about themselves, the task, and their group, and the strategies necessary to tackle the foreseen challenges.

Second, while the use of roles has been examined with respect to improving knowledge construction tasks or task performance, research is limited in examining how these roles correspond to the challenges they report facing in collaborative tasks. While knowledge construction is critical in collaboration, it is often more task-specific, such as in De Wever et al. (2007) where the roles supplied corresponded to tasks for the collaborative assignment. These challenges that learners face are ideal opportunities for regulation to occur, however, learners do not always have the strategies necessary to regulate.

Finally, in most collaborative tasks, learners are unfamiliar with the working

styles of group members and make decisions based on past group experiences. While some studies (see Schellens et al., 2007) examine the use of roles in successive group tasks, research is limited in examining how learners' perceptions from earlier task iterations informed their choices and process for future task iterations. As learners work together in successive iterations, they are learning more about each other and ultimately building knowledge with the potential to inform future decisions individually and as a group. By giving learners control of their choices, structuring supports to coincide with challenges, and providing successive iterations of a task, learners are provided with several opportunities to develop an understand of a complex task, plan utilizing information about themselves, the group, and the task, complete the task, and adapt both their enactment and metacognitive awareness moving forwards.

Leveraging roles as strategies for supporting collaboration. Roles are commonly assigned as a feature to support collaboration. However, when roles are provided to learners and require selection and adaptation, they become strategic tools used to support the processes of collaboration. Three areas have been underexamined with respect to the use of roles for promoting collaboration and mitigating collaborative challenges: (a) how well-suited roles are to the self-perceived needs of groups and individuals in groups, (b) does the use of roles alleviate challenges learners report encountering during collaboration and (c) how do learners leverage experiences with roles to plan more strategically for and conduct future collaboration.

Regulating Learning during Collaboration

Challenges that occur during collaborative learning create an ideal context for learners to regulate (Järvelä et al., 2013; Järvelä & Hadwin, 2013; Hadwin et al., 2011).

Recent literature proposes that regulation of learning has potential to improve collaborative learning outcomes (Hadwin et al., 2011). Self-regulated learning (SRL) is a process through which learners purposefully engage in their learning through setting goals and choosing, utilizing, and adjusting strategies as needed (Zimmerman, 1990). Theories of SRL are socio-historic in nature and emphasize learners' past experiences and outcomes as guidance moving forward. SRL requires learners to recognize if they are meeting goals and make strategic adaptations when needed (Winne & Hadwin, 1989). Regulation requires learners to utilize and adapt strategies to achieve their goals, and challenge episodes are an ideal time for regulation to occur (Zimmerman, 1990; Winne & Hadwin, 2008).

Recent perspectives have extended concepts of SRL to explain how regulation occurs as a social phenomenon. At a group level, learners strategically negotiate and adjust behavior, cognition, motivation, and emotional conditions (Hadwin et al., 2017). This collective level of regulation does not replace SRL but rather happens in addition to individual regulation. Learners draw from their individual beliefs and strategies to jointly build and inform their group's beliefs.

Phases of regulated learning. In Winne and Hadwin's (1998) model of SRL, learning occurs in a loosely guided, recursive, four-phase cycle. The first phase is task perceptions, in which learners identify the components of the task. Task perceptions are often revised over time, as students move forward in the SRL cycle and return to make revisions of their understanding (Greene, Hutchinson, Costa & Crompton, 2012). The second phase is goals and plans in which learners construct proximal and specific goals for their task. Goals are necessary for regulated learning because they help define

standards for planning, monitoring, evaluating, and adapting learning (Winne, 2011). The third phase is strategic engagement, in which learners draw on strategies and methods to move toward task completion. The fourth phase is large-scale adaptation in which learners make changes and adjustments based on their performance both within and beyond the current task or engagement episode. This model has also been applied to collaborative learning (Hadwin, Järvelä & Miller, 2011).

When examining this model at the collective level, socially-shared regulation of learning (SSRL) emerges when learners work together to develop their shared task perceptions, create shared goals for a task, choose and utilize strategies for the task, and adapt their approaches when necessary. Group members collectively monitor and evaluate the progress of the group (Hadwin, Järvelä & Miller, 2017).

Modelling the mechanisms of regulated learning. Winne and Hadwin (1998) proposed there is an underlying set of mechanisms supporting regulatory processes (phases). This cognitive architecture, COPES, consists of conditions, operations, products, evaluations, and standards. The processes of COPES occur within each phase of SRL and are broken down into (a) conditions, which focus on the context for each phase, including both external and internal factors; (b) operations, which are the cognitive processes, such as searching or monitoring, that students use to create products, (c) products, such as their standards for the task, which are the outcome of the cognitive operations (d) evaluations, in which learners judge their product, and lastly (e) standards, which are the learner's criteria for evaluating products (Hadwin & Winne, 2012).

When learners engage in collaborative tasks, they each come with their own conditions, both internal (e.g. beliefs, prior knowledge, products of previous regulation

phases) and external (e.g. environment resources, social context). Hadwin, Järvelä and Miller (2017) posit three types of conditions act on regulation at both individual and collective levels: (a) self-conditions, which consist of individual knowledge, (b) task and context conditions, which may include factors such as resources, time, or information about the group composition, and (c) group conditions, which are knowledge about individuals within the group, and may be informed by past experiences with the current and/or past groups. These conditions inform the decisions and actions of learners in both individual and collaborative learning.

Although several models of SRL exist in the literature (see Pintrich, 2000; Zimmerman, 1990; Winne & Hadwin, 1998), the Winne and Hadwin (1998) model (a) details the underlying processes of COPES, which are crucial to understanding how learners make choices about support in a collaborative activity and what information they utilize to make these choices and (b) applies the phases of regulation to collaborative learning through established research (see Hadwin et al., 2011; Järvelä, Jarvenoja, Malmberg & Hadwin, 2013). Every learner has their own conditions when they enter a collaborative setting, and these conditions need to be accounted for to understand why learners make certain choices about given supports.

Situating Conditions Within Support Choices

The proposed research situates decisions about supports (in this case role choices) in learners' prior experiences by offering students choices among collaborative roles closely aligned with challenges commonly reported in collaborative work. These roles were specifically designed to help mitigate the challenges learners face. The roles are coupled with scripts to provide learners tools to prompt metacognitive monitoring,

evaluating, and adapting within their group when faced with the corresponding challenges. Connecting roles to specific challenges, creates an optimal opportunity for students to regulate their learning while using provided supports. SRL theory posits students should purposefully choose roles as strategies to address past collaborative challenges and experiences as well as beliefs and perceptions they hold about their own competencies and strengths.

From a shared regulation perspective, students should draw on collective needs, experiences, and challenges to choose and negotiate among strategies and support (roles) best suited for their group in the task. Guiding the decisions learners make about roles is an array of self, task, and group conditions. By understanding the reasoning learners use when making decisions, supports can be revised to assist learners in regulating as a group. Examining the reasoning behind choices coupled with final role selection will reveal if learners are strategic about the roles they choose to enact in a collaborative task. If learners are not strategic when presented with support then they need to be provided with tools or a new skill set to make use of supports, otherwise the potential of roles is diminished in a collaborative context.

Purpose Statement and Research Questions

The purpose of this two-part study is to examine the strategic nature of role choices in terms of (a) why specific roles are chosen over others and (b) the influence of roles on student perceptions and outcomes of collaboration.

Part 1: Why do students choose specific roles?

1. What roles do students choose to support collaboration?
2. How do students' role choices change over successive collaborative tasks?

3. What reasoning do students provide for choosing those group roles?
4. How does reasoning behind role choice change over successive collaborative tasks?

Part 2: Do roles improve collaboration?

1. Did individuals assess team performance in each challenge area higher for (a) challenges targeted by roles their group selected or (b) challenges targeted by roles their group did not select?
2. How do roles influence perceptions of self and shared regulation?
3. How do students' perceived usage of roles influence their perceptions of self and shared regulation?

Chapter 3 Methods

Research Context

This study is situated in an undergraduate elective graded course on learning strategies for university success focused on: (a) developing knowledge, skills, and strategies about SRL, (b) applying SRL knowledge to authentic learning tasks and situations, and (c) developing metacognitive awareness of learning and collaboration. As part of the course, students completed two collaborative computer supported assignments requiring them to work with a group and apply course concepts to analyze a scenario about a student facing common tasks in university. Each collaborative task took approximately three weeks to complete (Task 1: started in week 4; Task 2: started in week 8 and included a week long break from classes) and was divided into three main phases: (a) *planning*, in which students planned and prepared for the collaborative task both individually and in groups, (b) *doing*, in which students had 90 minutes to complete an online collaborative task via synchronous chat and (c) *reflecting*, in which students were guided to self-assess and reflect on their performance and processes during teamwork.

Collaborative tasks were required components of the course. The finished product from the *doing* phase of each task was graded for accurate application of course concepts to the scenario (each task counted for 10% of final mark in the course). Completion (but not content) of the planning and reflection phases was counted toward an individual responsibility mark for the task (each responsibility mark contributed 5% of the final mark in the course). The planning portion of the task was marked on students' completion of various planning activities, including a solo planner and an individual

summary sheet. The self-reflection was marked based on how authentic students were in their responses and their willingness to acknowledge problems or ways their group could improve for future collaboration. This self-reflection mark contributed to their personal responsibility mark for the collaborative task.

Participants

Participants included 111 undergraduate students, average age = 19.25 (*SD* = 1.64), with 49% female. Of the sample, 58% of students were in their first years of post-secondary education. The faculty with the highest representation of students was the Faculty of Social Sciences, with 48% of the sample. Students were assigned to one of 26 groups (k) including nine groups of 5 students, fifteen groups of 4 students and two groups of 3 students. Groups were created from within the lab sections of the course by their respective lab instructors, and due to varying lab sizes, the groups varied in number of members. Efforts were made to distribute students across heterogeneous groups based on past performance, language proficiency, and gender. Students remained in the same groups for the second task; however, groups with members who did not complete the task were not included in the analysis.

An ethical review board process for implied consent was used. All students in the course were informed on multiple occasions that enrolling in the course gave implied consent to participate in research about academic success unless they withdrew their consent. Students were reminded of their right to withdraw consent at any point during (or after) the course without the professor or lab instructors knowing until grades were posted by clicking on a decline consent button in their course management environment.

Criteria for inclusion in this study include (a) all group members consenting to the

research and (b) participation in the first collaborative planning session. Groups comprised of students who did not complete the first collaborative task and were subsequently removed from their group for the second task were not included in any related analyses (k=3).

Procedures

This study utilized data collected in two collaborative tasks that students competed from weeks 4 to 6 and 8 to 12 respectively (see *Figure* 1). These two tasks unfolded over three phases: planning, doing, and reflecting.

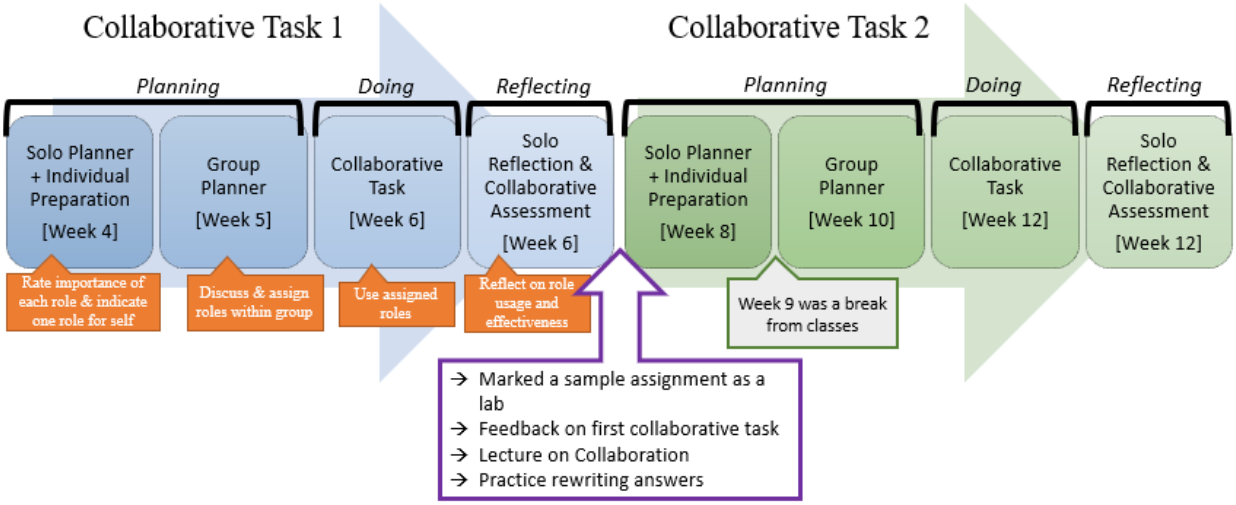

Figure 1. Organization and phases of the two collaborative tasks.

Prior to completing the collaborative task, learners engaged in the *planning* phase. The *planning* phase was initiated with solo planners, completed individually over the span of a week, and prompted individuals to examine due dates of upcoming task components, evaluate the importance of group roles, and identify a preferred role for themselves. In addition to the solo planner, students were required to complete a summary sheet containing course concepts and information to use during the task. For Task 1, Group planners were completed during the course lab time the week before the

collaborative task. Participants were given 35-minutes to discuss their group plan during lab using Zoho Chat, an online synchronous chat tool, and to record the plan in a shared wiki space on the university's instance of Moodle that allowed one designated editor (Modular Object-Oriented Dynamic Learning Environment, Dougiamas, 2001). For Task 2, the group planner was completed over a span of 10 days outside of class via the synchronous chat tool. The group planner prompted students to evaluate challenges, create a plan, and choose/assign group roles. Students could work more on their group plan outside of lab using the same synchronous chat tool.

For the *doing* phase, students completed the collaborative task over a 90-minute class during weeks 6 and 12. They communicated through synchronous text-based chat and produced answers in a shared wiki space. Each student had a group role designed to be enacted during this phase.

Finally, for the *reflecting* phase, students completed a guided reflection. This reflection was completed in class for Task 1 and was assigned as homework for Task 2. The solo reflection consisted of a collaborative self-assessment and a guided reflection, prompting students to discuss strengths, weaknesses, and areas for improvement related to the collaborative task and future collaboration. Additionally, students reflected on their usage of their group role and the effectiveness of roles within the group.

Unique to the first collaborative task were activities and opportunities implemented to prompt reflection and large-scale adaptation for the second task. These included: (a) feedback and marks from their group performance and personal responsibility from the first collaborative task, (b) a lecture on collaboration, and (c) practice rewriting one of their answers from the task and (d) marking a sample

assignment as a class following the rubric used in evaluation of the product from the actual task.

Supports for collaboration. Students were provided with three supports to structure and facilitate collaboration within each task: group roles and two types of support visualizations (role rating and confidence). Students were introduced to the group roles in their first solo planner (Task 1, week 4). Students referred to these roles in individual and group planning for Task 1 and 2, with the intention of utilizing them during the collaborative tasks (weeks 6 and 12). The two support visualizations were provided in the group planner and were based on information provided by individuals in the group when completing their solo planner. The support visualizations were not data sources for the current study, however, they were information provided to students.

Group roles. Research has highlighted several common common group challenges (motivation, socio-emotional, cognitive, metacognitive, environmental; e.g., Naykki et al., 2014). These challenges, augmented with frequently identified challenges by students in earlier offerings of the same course, were used to develop group roles aligning with seven main categories of challenges (see Table 1). The seven challenge categories and their corresponding roles are: (a) motivation (motivation magician); (b) concepts/domain knowledge (SRL word wizard); (c) progress checking (task wrangler); (d) socio-emotional (climate coach); (e) strategic planning (planning engineer); (f) participation (participation promoter); and (g) communication (communication coordinator). These seven roles were designed for students to use during the task and promoted metacognitive monitoring, evaluating, and adapting while targeting these

challenge categories. Each role was coupled with a purpose and relevant monitoring prompts for students to utilize when enacting their role for the task.

Table 1

Group roles, purpose of the role, related questions, and challenge target of the role

Role title	**Role purpose**	**Monitoring questions related to role**	**Challenges targeted by this role** [a]
Motivation Magician	This person's job is to monitor, prompt, guide and redirect things related to confidence, attitude, and commitment.	Are we all committed to the task? Are we all approaching the task with a positive attitude? Are we focusing our effort on things in our control?	Promoting confidence for the task Encouraging positive attitudes or work habits Encouraging task commitment and persistence Acknowledging great work Maintaining interest and incentive Focusing on task value Focusing on things we can control/change
SRL Word Wizard	This person's job is to monitor, prompt, guide and redirect things related to appropriate and distributed use of course concepts for the task.	Are we including specific course concepts in the final product? Are we accurately describing the course concepts? Do the course concepts we used relate to what the question is asking?	Encouraging use of course concepts and terms Monitoring accuracy of course concepts Using relevant course concepts Using a breadth of course concepts
Task Wrangler	This person's job is to monitor, prompt, guide and redirect things related to time management, task approaches, and task standards.	Are we checking the time? Are we staying on task? Are we using appropriate strategies and approaches to complete the task?	Balancing individual task standards Monitoring use of time Keeping us on task Balancing different task approaches Promoting task appropriate strategies Estimating time/effort required for task components Working within time and resource constraints
Climate Coach	This person's job is to monitor, prompt, guide and redirect things related to group trust, conflict management and create a welcoming space for differing ideas and perspectives.	Are we addressing conflict when it arises? Are we creating a positive and trusting environment? Are we encouraging different perspectives of the ideas?	Creating a welcoming space for differing ideas and perspectives. Promoting & Developing Trust in each other Encouraging consensus building Building positive relationships Monitoring & Managing team conflict

Planning Engineer	This person's job is to monitor, prompt, guide and redirect things related to roles, checking progress, and revising plans.	Are we clear on our roles and responsibilities? Are we revising our plans as the task progresses? Are we developing an understanding of what we need to do?	Negotiating and clarifying roles/ responsibilities Checking progress against goals or standards Prioritizing work, roles, or tasks Negotiating understanding of what we have to do Revising plans or work Figuring out what team members are good at Identifying/negotiating goals and objectives Deciding how to start
Participation Promoter	This person's job is to monitor, prompt, guide and redirect things related to sharing the workload, monitoring contribution distribution, and utilizing strengths within the team.	Are we sharing the workload? Are we all contributing? Are we working to the same standards?	Ensuring shared workload Encouraging fulfillment of roles/ responsibilities Monitoring distribution Contributions Drawing out expertise within the team
Communication Coordinator	This person's job is to monitor, prompt, guide and redirect things related to prompting feedback, working through language differences, and encouraging active listening within the group.	Are we clearly communicating their ideas and perspectives? Are we providing clarification when language differences are present? Are we providing feedback to each other on the answers?	Clarifying understanding what team members are saying Encouraging active listening to different ideas and perspectives. Promoting clear communication of ideas and perspectives Prompting feedback Working through language differences

[a] students were not provided these direct links to challenges at any point in time while planning

Roles were first introduced to students in their solo planner and reappeared in the group planner. Students were provided with all seven roles to choose from, offering them the opportunity to negotiate among the roles. For each role, a role sheet was provided by the instructor and included: (a) a description of the role, (b) questions to be asked when enacting this role, (c) guidelines to prepare for the role, and (d) spaces to create personalized prompts (see Appendix A). The role sheet was provided for students to use during the collaborative task to refer to the prompts or tasks of the role. This sheet also included prompts that students developed in consultation with their group during planning

Role rating visualization. When individually planning for Task 1 and 2 (solo planner weeks 4 and 8), students rated the importance of each possible group role on a 6-point Likert scale from 1 (not a priority) to 6 (high priority). Aggregated group ratings were summarized for each group by calculating averages and visualized in a chart to guide group selection of roles for the task. For each group, each role was visualized as a circle, with red being high priority (average greater than 4.5), orange was medium priority (average between 3 and 4.5), and green was low priority (average of less than 3; see *Figure 2* for example of visualization from one group). This coloring was established based on the average role rating across all individuals in the course (M=4.60, SD=1.20). The role rating visualization was provided prior to the question in the group planner asking groups to negotiate roles for the task. Groups only received a role rating visualization if at least one student completed the solo planner. If no members of the group completed their solo planner, then a visualization was not provided to that group.

Figure 2. Role-rating visualization. Groups were provided with this visualization in their group planning sessions to represent the planning they did individually.

Confidence visualization. In addition, in the solo planner students rated 12 items relating to confidence regarding various aspects of the task, from 1 (not at all confident) to 5 (very confident). This was then provided as a planning support to groups to discuss challenges their group may face; however, the confidence visualization may have informed the role choices that groups made. A visual summary of collective responses within the group was presented in bar graph available to groups during group planning to identify potential challenges they may face as a group. *Figure* 3 shows a confidence visualization for one group. Items one standard deviation above the group's mean were displayed in green, items one standard deviation below the group's mean were displayed in red. Items within one standard deviation of the mean were displayed in yellow. As part of a larger research project, groups were divided amongst two conditions for Task 1 in regard to receiving the visualization - receiving it and not receiving it, with only 11

groups receiving the confidence visualization. For Task 2, all groups were given the confidence visualization. This visualization may have impacted decision making within groups, and analyses were conducted to determine if it was a significant factor.

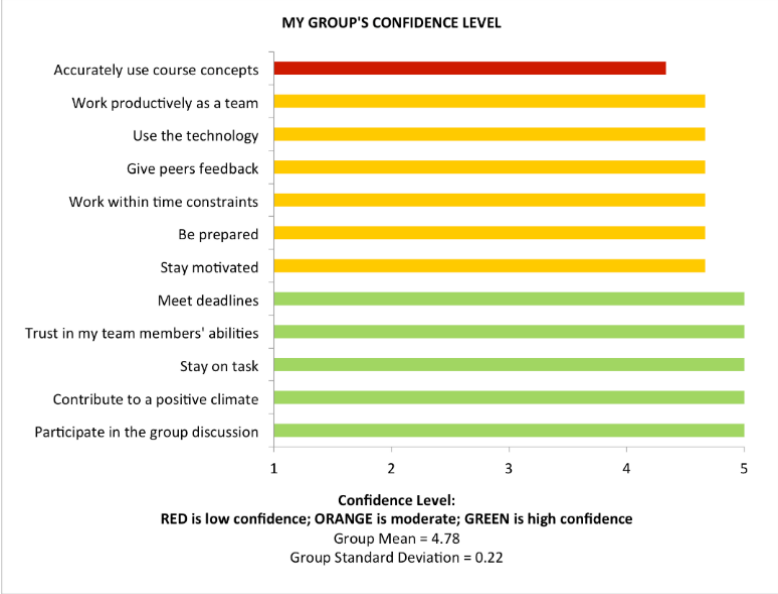

Figure 3. Confidence visualization.

Data Sources

Data for this study were drawn from the *planning* phases and the *reflecting* phases of both collaborative tasks (see grey callout boxes in Figure 4).

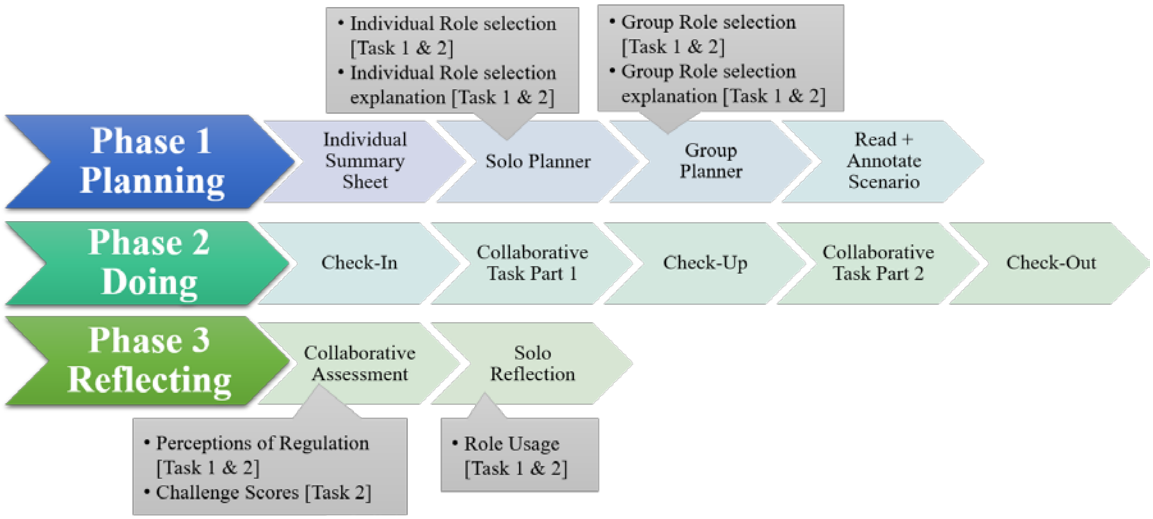

Figure 4. Timing and context of each data source across Task 1 & 2.

Part 1: Examining role selection and reasoning. Data sources used to examine students' role choices were collected during the planning phase of both the first and second collaborative task. Specifically, data sources were compiled from the solo and group planners.

Solo planner: individual role selection. In the solo planner (see Appendix B), students were prompted to answer, "*given a choice, which role would you like for [the task]*." Students were provided with seven role choices that correspond with frequently encountered challenges (See *Figure 5*) in a drop-down menu and could select only one.

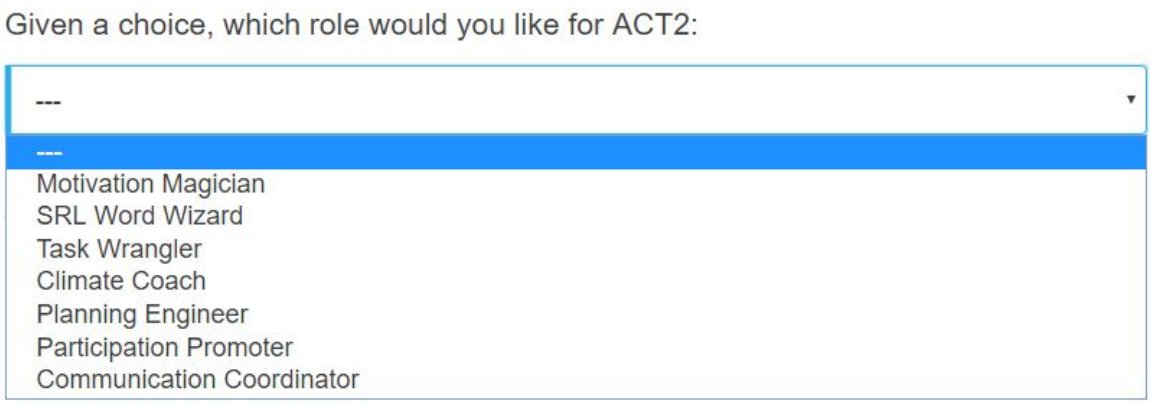

Figure 5. Role Choice Prompt from Solo Planner 1 and 2

Solo planner: individual role selection explanation. After identifying what role, they would prefer to enact, students were prompted to follow-up their choice by being prompted to answer, "*and why*" for the role they chose. An open-ended text field followed this question. Explanations were coded in the analysis phase.

***Group planner: group role selection*.** In the group planner (see Appendix C), students were prompted to use the role rating visualization to (a) discuss roles they should choose for the task, and (b) assign one role to each group member recording those specific choices in a shared wiki.

Group planner: group role selection explanation. After choosing and assigning

roles, the group planner prompted groups to explain why each role was chosen or assigned for the task. These explanations were coded in the analysis phase.

Part 2: Impact of roles. Data sources used to examine the impact of roles came from the second group planner and collaborative self-assessment described below.

Collaborative self-assessment: perceptions of regulation. The first part of the collaborative self-assessment measured student's perceptions of their regulation. Students individually rated a series of 41 potential actions during collaborative work (e.g., checked progress against goals or standards) on an 11-point interval scale from -5 (something I did individually) to 5 (something we did as a group). The middle point, 0, referred to not applicable and therefore represented neither individual or shared regulation for analysis. For analysis, assessment scores were converted to a scale from 1 to 11, with "not applicable" represented as a 6. A score close to 11 represents more shared regulation, while a score closer to 1 represents more self-regulation. Each item on the assessment targeted specific challenge-related actions associated with each role (see Table 1 above). Each challenge-associated role had a subscale on the assessment, with a varying number of items per subscale (Appendix D).

Collaborative self-assessment: challenge scores. The second part of the collaboration assessment involved examining perceptions of challenges experienced during the collaboration. This data was only analyzed for Task 2. They were also informed that this had no bearing on their actual performance mark for the task. Individuals were prompted with the question: "*what grade (out of 10) would you give your team on each of the following…*" which was then followed with a series of clustered challenges that related to each role option (see Table 1 for challenge clusters relating to

each role). Alignment between challenge and role was not made explicit because the collaborative self-assessment was designed to have students reflect on how their group responded to challenges, rather than if their roles were effective. For example, the challenge group related to motivation magician listed the following items: "*Confidence, positive attitudes, commitment, and persistence, acknowledging good work, maintaining interest, focusing on the value of the task, and focusing on things in our control*." Rather than listing challenge categories, all the individual challenges within each category were listed (see Appendix E). Students individually rated their group's performance regarding these challenges on a ratio scale from 0 (lowest score) to 10 (highest score). A lower score (closer to 0) on this scale corresponds to individuals perceiving the group's performance when faced with these challenges was poor.

***Self-reflection: role usage*.** Students self-reported their usage of roles in the guided self-reflection. Students were guided to answer the question "*how often did you remember to BE the role you selected during planning*" with one of five nominal choices: (a) never - I forgot all about it, (b) never - I didn't have time, (c) once or twice, (d) regularly throughout the chat and (e) I didn't remember what my role was.

Chapter 4 Findings

Analyses examined role choice and how roles influenced collaboration. Analyses and findings are presented below.

Preliminary Descriptives and Analyses

Prior to proceeding with the main analyses, preliminary analyses were conducted to determine if differences existed across comparison conditions.

Confidence visualization support. While the comparison (confidence visualization or no confidence visualization) only existed for Task 1, analyses were carried out across both tasks in case the effects of the condition lingered. To examine the effects of the confidence visualization condition on the varying nominal data sources (e.g., role choice, role reasoning) chi-square tests of independence were used. To examine the effects of the confidence visualization on the interval scale data (e.g., challenge scores, perceptions of regulation), independent t-tests were used. All analyses returned a non-significant result (see Table 2 and Table 3), and thus the sample was not treated as two separate conditions for the remaining analyses.

Table 2

Chi-square comparison of role choices, role reasoning, and role usage across confidence visualization conditions (received/did not receive) for two tasks.

Data Source	Task 1	Task 2
Individual Role Choice	$X^2(6) = 8.03$, $p = 0.24$	$X^2(6) = 8.42$, $p = 0.21$
Group Role Choice	$X^2(6) = 2.47$, $p = 0.87$	$X^2(6) = 2.13$, $p = 0.91$
Individual Role Reasoning	$X^2(5) = 2.17$, $p = 0.83$[a]	$X^2(6) = 6.24$, $p = 0.40$
Group Role Reasoning	$X^2(5) = 6.21$, $p = 0.40$[a]	$X^2(6) = 6.68$, $p = 0.35$
Role Usage	$X^2(3) = 1.77$, $p = 0.62$	$X^2(2) = 1.34$, $p = 0.51$[a]

[a] Degrees of freedom vary due to not all options being chosen

Table 3

Independent t-test comparison for perceptions of regulation and challenge scores across confidence visualization conditions (received/did not receive) for two tasks

Data Source	Task 1	Task 2
Perceptions of Regulation	t(91)= .193, p = .848	t(64)= -.469, p = .640
Role-related Challenge Scores		t(87)= .-1.539, p = .127
Non-role-related Challenge Scores		t(87)= -1.187, p = .239

Note: Challenge scores only examined for Task 2

Part 1: Why do students choose specific roles?

This section presents a series of descriptive analyses to examine the roles chosen by individual students and by groups. Frequency data was used to examine the roles students chose within each task. Transitional matrices were used to examine changes in role choice across tasks. Content analysis was used to qualitatively code and categorize the reasons students provided for specific role choices. Frequencies of codes were examined to identify patterns in role reasoning within each task. Transition matrixes were used to examine changes in role choice reasoning from Task 1 to Task 2. These analyses aim to build an understanding of how students made decisions among the varying role choices.

Question 1: What roles do students choose to support collaboration?

Frequency and percentage of individuals and groups choosing roles are presented in Table 4. For individuals, the three most frequently chosen roles for Task 1 and 2 were the task wrangler (Task 1=18%; Task 2=24%), SRL word wizard (Task 1=17%; Task 2=14%), and the motivation magician (Task 1=16%; Task 2=18%). These most frequently chosen roles were replicated in the group planning, with task wrangler (Task

1=16%; Task 2=19%), SRL word wizard (Task 1=18%; Task 2=19%), and the motivation magician (Task 1=16%; Task 2=15%). Thus, it appears that both individuals and groups chose roles directly related to strategic task engagement, motivation, and domain/concept usage.

The least frequently chosen roles in individual planning were the climate coach (6%) for Task 1, and the planning engineer (7%) and the climate coach (7%) at Task 2. In contrast, the least frequently chosen roles in group planning were the communication coordinator (10%) for Task 1, and the planning engineer (11%) and climate coach (11%) for Task 2. Thus, students less often chose roles related to communication, planning or climate.

Table 4

Percentage and frequency of individuals and groups choosing each role for the solo and group planners for Task 1 and 2.

Role	Solo Planner Task 1 (N=111)		Solo Planner Task 2 (N=97)		Group Planner Task 1 (N=111)		Group Planner Task 2 (N=97)	
	%	(f)	%	(f)	%	(f)	%	(f)
Task Wrangler *focuses on time management, task approaches, & task standards*	**18%**	**20**	**16%**	**18**	**24%**	**23**	**19%**	**18**
Motivation Magician *focuses on confidence, attitude, & commitment*	**16%**	**18**	**16%**	**18**	**18%**	**17**	**15%**	**15**
SRL Word Wizard *focuses on appropriate and distributed use of course concepts for the task*	**17%**	**19**	**18%**	**20**	**14%**	**14**	**19%**	**18**
Participation Promoter *focuses on sharing the workload, monitoring contributions, & utilizing strengths within the team*	12%	13	11%	12	13%	13	9%	9
Planning Engineer *focuses on roles, checking progress, & revising plans*	10%	11	15%	**17**	7%	7	11%	11
Communication Coordinator *focuses on prompting feedback, language differences & encouraging active listening*	11%	12	10%	11	8%	8	13%	13
Climate Coach *focuses on group trust, conflict management & creating a welcoming space*	6%	7	13%	14	7%	7	11%	11
Missing	10%	11	1%	1	8%	8	2%	2

Note: Bolded items represent the three most frequently chosen roles for the respective planning session

Question 2: How do students' role choices change over successive collaborative tasks? Overall, role choice changed minimally between Task 1 and 2 across both individual and group planning. The most notable change was in individual planning for the Task Wrangler, which was selected more frequency for Task 2 (Task 1=18%; Task 2=24%). This change was not seen in the group planner, which reflected a decrease in the assigning of the Task Wrangler role.

Conditional probability matrices were used to examine changes in role choices for each student. The frequency of choosing each role for Task 2 based on their role choice for Task 1 was calculated for each role. This frequency was calculated by taking the number of students who chose this role and dividing it by the total number of students. Students could either: (a) choose a new role, (b) use the same role or (c) neglect to fill out one of the planners. Analyses revealed that a majority of students chose a different role for Task 2 (See Table 5). For individual planning, 62% of students chose a different role than Task 1 when planning for Task 2. For group planning, 60% of students were assigned a different role for Task 2.

Transitional matrices were also used to examine changes in individual role choice compared to group role assignment for that individual. The frequency of being assigned each role in group planning based on their role choice in individual planning was calculated for each role for Task 1 and 2. Frequency of choosing a role for Task 2 individual planning based on their group role from Task 1 was also calculated. Students could either: (a) choose a new role, (b) use the same role or (c) neglect to fill out one of the planners. Findings indicated that 54% of students were assigned a different role than they had indicated in their individual planning for Task 1. This decreased slightly to 49%

for Task 2. Findings also indicated a majority of students (57%) changed their roles from the first group planner to the second solo planner, highlighting a need to choose a role different than the one they had been assigned for the first task.

Table 5

Percentage of students who changed or did not change their role between planning iterations across Task 1 and 2.

	Chose/assigned different role	Chose/assigned same role	Incomplete Data[a]
Solo Planner Task 1 to Solo Planner Task 2	62%	22%	16%
Group Planner Task 1 to Group Planner Task 2	60%	37%	3%
Solo Planner Task 1 to Group Planner Task 1	54%	35%	11%
Solo Planner Task 2 to Group Planner Task 2	49%	41%	9%
Group Planner Task 1 to Solo Planner Task 2	57%	43%	9%

[a]Students who did not fill out one of the planners for Task 1 or 2

Question 3: What reasoning do students provide for choosing those group roles? Coding of reasoning for role choice was guided by a priori definitions of conditions that have potential to inform decisions when regulating in collaboration (Hadwin, Järvelä & Miller, 2017), and flexibly and inductively informed by the data itself. This led to emergent coding categories using data to extend the original theoretically driven framing of reasons behind role choices.

Initial codes were self, task and group conditions. However, examination of the data revealed important overlaps between codes, because students' statements were not

always mutually exclusive to one category and made important conceptual connections between two or more sources (see Figure 6). For example, one reason provided in a group planner was “we feel that we need everyone [to feel] comfortable participating. Lucy feels this is a strength of hers.” This statement overlaps both with group and self-conditions, as the group has identified a need they have in addition to Lucy being able to identify her personal strengths for the role. By identifying the overlap between these codes, it became apparent some students were utilizing multiple sources of information to make decisions.

The coding process unfolded through multiple iterations. First, statements from all four data collection points (2 solo planners and 2 group planners) were combined, with source identifiers removed (i.e., no participant number, group number, etc.). Statements were then divided into three a priori categories guided by the theory (Hadwin, Järvelä & Miller, 2017). Four additional codes quickly emerged from the data (as described earlier) resulting in the addition of overlapping codes (as previously discussed).

The four additional codes were: (a) self-group, (b) self-task, (c) group-task, and (d) self-group-task (see Table 6). These codes represented the intersect of the sources of information being used. For example, a statement coded as self-task would contain elements of information that the student knows or perceives about themselves situated or related to information about the task or provided roles. After these statements were coded, a team of experts in the field of Self-Regulated Learning and collaboration reviewed codes and data examples and made suggestions for revision or fine-tuning. Statements were then re-coded, with context (group and participant numbers) removed except for what role the student had chosen/been assigned. Role assignment was used to

add clarification to students' intent in the explanations. Interrater reliability was established in two stages. First, 20% (n=90) of student statements were randomly selected for coding by an independent rater. Discrepancies were identified, discussed, and resolved by making slight changes and clarifications to the coding scheme. Second, after recoding the statements following the revised coding scheme, another 20% (n=90) were coded by an independent rater and reliability was acceptable (Cohen's Kappa = .846; cf Landis & Koch, 1977).

Figure 6. Visual representation of the coding scheme and the overlapping of the codes.

Table 6

Coding scheme identifying conditions students can draw from when making decisions in a collaborative task

Code	Definition
Self	- "Individual knowledge, beliefs, strengths & weaknesses" (Hadwin et al., 2017) - Statements expressing personal interest/ strengths - Individual beliefs *not* pertaining to knowledge about the task
Group	-Specific to the collaborative learning context - beliefs about groups and the individuals within groups - Relating to past group experiences - drawing from conversations or decisions made by the group
Task	- explicit task information; e.g., role description, task components (such as using course concepts) - "External affordances and constraints in the task and task content" (Hadwin et al., 2017)
Self-Group	-statements containing both self and group elements - identifying a perceived group need or benefit and knowledge about the individual (strengths, beliefs, etc.) leading to that role assignment
Self-Task	-statements acknowledging an individual's knowledge/ beliefs/ strengths/ weaknesses but also connect to the task either through a constraint or affordance -situating beliefs about MYSELF within the components, constraints, or affordances of the task
Group-Task	- contains elements of both task and group - often emphasizes a group condition (e.g., we had poor time management) but connected to a constraint (e.g., due to limited time) - connects group experience or knowledge with information they have or perceive about the task
Self-Group-Task	- students are acknowledging all factors in making choices - considers group experiences, individual beliefs/attributes and why it matters for the task

Frequency and percentages of individuals and group's reasoning are presented in Table 7. Individuals most frequently based role choice decisions on information and beliefs about the task (26%) for Task 1 and information about themselves (29%) at Task 2. This demonstrates students draw on different types of information to make role choices after having more task and group experience. In contrast, at the group level, the conditions most frequently informing role choice reasoning were Task (Task 1=39%; Task 2=32%) with the second most frequent being Group-Task (Task 1=24%; Task

2=19%). This demonstrates students primarily utilized information about their task but augmented that with information about their group members or past experiences. These findings also demonstrate role choice reasoning is informed by different conditions at the individual versus group level. The overall distribution of reasoning did not shift much from Task 1 to 2. To delve deeper into how reasoning shifts, individual and group changes were examined more closely.

Table 7

Percentage and frequency of role reasonings for individual and group planning for Task 1 and 2

Role Reasoning	Solo Planner Task 1 (N=111)		Solo Planner Task 2 (N=97)		Group Planner Task 1 (N=111)		Group Planner Task 2 (N=97)	
	%	*(f)*	%	*(f)*	%	*(f)*	%	*(f)*
Self	**23%**	**25**	**29%**	**28**	14%	16	15%	15
Group	8%	9	1%	1	10%	11	11%	11
Task	**26%**	**29**	**21%**	**20**	**39%**	**43**	**32%**	**31**
Self-Group	12%	13	9%	9	6%	7	5%	5
Self-Task	18%	20	**21%**	**20**	5%	5	6%	6
Group-Task	4%	4	9%	9	**19%**	**21**	**24%**	**23**
Self-Group-Task	0	0	2%	2	2%	2	4%	4
Missing	10%	11	8%	8	5%	6	2%	2

Note: Bolded font represents the more frequently utilized reasonings according to most top percentages per planning iteration.

Question 4: How does role reasoning change across successive planning tasks? To examine how role choice reasoning changed from Task 1 to 2, transitional matrices were used to calculate the conditional probability of each change in role reasoning. Transitional matrices were constructed by recording the probability of each

type of role reasoning for Task 2 based on each individual's choices for Task 1. This analysis highlights whether individuals had stable or changed role reasoning across tasks. For this analysis, the coding from the previous analysis was condensed to highlight how students changed between primarily self and group conditions. Due to the small sample size, condensing codes made patterns more apparent. Self-Task and Self were combined into "SELF" while Self-Group, Group-Task, Group, and Self-Group-Task were combined into "GROUP." The Task code remained a solo code. The condensing was done this way to highlight the group-level conditions, as this study primarily focuses on the differences in how self versus group conditions were used. By condensing the coding scheme, it highlighted if the students were more individually or group oriented by having a singular metacognitive condition (self, group, or task) that students were using to guide their strategic decision making.

Change of individual planning reasoning. While findings revealed similar frequencies of role reasonings at Task 1 and 2 (see above), further examination showed approximately half of the students changed their reasoning from Task 1 to 2 (40%). Likewise, a similar proportion of students used the same (or similar) reasoning for Tas 2 (43%). Furthermore, findings indicated that individuals who considered self-condition reasoning in Task 1 were very likely to consider self-conditions for Task 2 (see Table 8). Of the students who provided reasonings in both solo planners, the majority of students who changed their reasoning switched to a self-focused condition (20%). Students who reported basing role choice decisions on group or task information in Task 1 were also slightly more likely to base those decisions on information about themselves for Task 2 (Table 8; rows 2 and 3).

Table 8

Frequency of individual role reasoning for Task 2 (rows) based on Task 1 (columns) reasoning

	SELF - Task 2	GROUP- Task 2	TASK- Task 2	MISSING- Task 2
SELF- Task 1	**25**	7	7	2
GROUP - Task 1	11	**6**	2	3
TASK - Task 1	9	6	**8**	1
MISSING - Task 1	3	2	3	2

Note: Numbers in bold represent students who did not change their role reasoning

***Change of group planning role reasoning*.** To examine how each group's role reasoning changed from Task 1 to 2, a difference score for each group was calculated by subtracting the frequency of each condition/reasoning for Task 1 from the amount at Task 2. For example, for Task 1, Group 4 had four 'group' role choice reasonings. For Task 2, Group 4 had one 'self,' two 'group' and one 'task' role-reasoning. For each role-reasoning, a difference score was calculated, resulting in scores of +1 for self, -2 for group, and +1 for task. This difference score represents how the distribution of reasonings changed across the two successive tasks. These scores were averaged across all groups. From Task 1 to 2 there was an overall decrease in usage of self (mean difference = -.60) reasons and an increase in group reasons (mean difference = .60).

Part 2: Do roles improve collaboration?

To examine the impact roles had on collaboration, two outcomes measures were examined: (a) *challenge ratings* indicating the degree to which a series of role-related challenges were reported, (b) *perceptions of regulation* indicating whether a series of role-related actions were enacted by the group or themselves (rated on a continuum).

Question 1: Did individuals assess team performance in each challenge area

higher for (a) challenges targeted by roles their group selected or (b) challenges targeted by roles their group did not select? To examine the effectiveness of roles, two scores were calculated from *challenge ratings* for each individual (N=89): (a) the weighted mean for performance in response to challenges corresponding to roles chosen within their group as indicated in the group planner and (b) the weighted mean for performance in response to challenges corresponding to roles *not* chosen within their group (see Table 9). The average rating of challenges corresponding to chosen roles (M = 8.18, SD = 1.59) versus challenges corresponding to roles not chosen (M = 8.19, SD = 1.67) were virtually equal. Furthermore, when students reported higher levels of challenges in role-related challenges, they also reported higher levels of challenges in non-role related challenges as indicated by a moderate positive correlation ($r(89)=.65$, $p<.001$) with 42.25% of the variation in role-assigned scores being accounted for by the not-assigned roles.

Table 9

Mean scores for individual's responses to group performance in response to potential challenges

Role	Role Assigned in Group average (*std dev)*	Role Not Assigned in Group average (*std dev)*
Task Wrangler *focuses on time management, task approaches, and task standards*	7.95 (2.04)	8.81 (1.29)
Motivation Magician *focuses on confidence, attitude, and commitment*	8.67 (1.52)	8.07 (2.16)
SRL Word Wizard *focuses on appropriate and distributed use of course concepts for the task*	8.43 (1.64)	8.59 (1.22)
Participation Promoter *focuses on sharing the workload, monitoring contributions, and utilizing strengths within the team*	7.21 (2.85)	8.00 (2.14)
Planning Engineer *focuses on roles, checking progress, and revising plans*	8.22 (2.04)	7.67 (1.85)
Communication Coordinator *focuses on prompting feedback, language differences and encouraging active listening*	8.53 (1.74)	8.43 (2.25)
Climate Coach *focuses on group trust, conflict management and creating a welcoming space*	8.39 (2.26)	8.25 (2.07)

Question 2: How do roles influence perceptions of self and shared regulation? To examine individual's perceptions of self and shared regulation, data from students' *perception of regulation scores* from the collaborative self-assessment were used. A score close to 11 represents more shared regulation, while a score closer to 1 represents more self-regulation. This midway score represents neither self or shared responsibility for the regulatory action or process. The number of individuals reporting "not applicable" was examined. The most frequent "not applicable" item (Working

through language differences) had 13 participants choose this for Task 1 (out of N=93). No items were removed from further analyses.

Mean *perception of regulation* scores were calculated for each student according to four subscale categories: (a) role assigned to individual – only items corresponding to their own role, (b) roles assigned to other individuals in group – only items corresponding to their other group members' roles, (c) roles not assigned in group – all items corresponding to roles not assumed by any member of their group, and (d) total regulation – all items across all role categories (see Table 10).

Overall, scores shifted slightly toward individually focused regulation from Task 1 (M=9.19) to Task 2 (M=8.71), with variation amongst individual's responses also increasing. Within student differences in *perceptions of regulation* for their role was examined from Task 1 to 2 with a paired samples t-test. Data were negatively skewed, so data was transformed by squaring all values (See Table 11). *Perceptions of regulatory* actions became significantly more self-focused (decreased) between Task 1 (M=89.56, SD=29.25) and Task 2 (M=77.01, SD=34.02); t(63)=2.65, p=.01.

Table 10

Average ratings (and standard deviation) for individual's perceptions of regulation for Task 1 and 2.

Task	Individual's Role	Roles Assigned to other group members	Roles not used in group	All Role Categories
Task 1	9.30 (*1.75)*	9.25 (*1.59)*	9.18 (*1.78)*	9.19 (*1.70)*
Task 2	8.35 (*2.39)*	8.77 (*1.87)*	8.61 (*1.98)*	8.71 (*1.79)*

Table 11

Original and transformed data set for individual's perceptions of regulation in relation to their assigned role

	Original Data Task 1	Original Data Task 2	Transformed Data Task 1	Transformed Data Task 2
Mean	9.27	8.46	89.56	77.01
St Dev	1.94	2.34	29.25	34.02
Kurtosis	5.26	1.58	.79	-.83
Skewness	-2.02	-1.21	-1.06	-0.39

Question 3: How do students' perceived usage of roles influence their perceptions of self and shared regulation? Individual's perceptions of self versus shared regulation were compared across how frequently individuals self-reported using their roles (see Table 12). While individual's ratings did not vary greatly among reported role usage, there was a slight difference between students who reported using their roles regularly versus those who did not. These students reported lower values for their own roles, leaning more towards individual regulation. When comparing individuals who used their roles regularly with individuals who used them once or twice, individuals who used them regularly reported slightly higher scores, or more shared regulation.

Table 12

Individually reported regulation across individuals' self-reported use of roles.

	Task 1			Task 2		
Use of roles	# of participants	Average for Individual's Role	Average for all role categories	# of participants	Average for Individual's Role	Average for all role categories
Never used role	3	10.02	10.19	1	8.25	6.54
Once or Twice	26	9.32	9.16	12	8.5	8.45
Regularly throughout chat	61	9.25	9.17	53	8.32	8.81
Did not remember role	1	10.86	10.66	0	0	0
TOTAL	91			66		

Note: Scores are representative of individual's regulation on a scale from 1, more self-regulation to 11, more shared regulation.

Chapter 5 Discussion

While research exists on the effectiveness of roles in collaborative learning (Strijbos et al., 2004), the purpose of this two-part study was to examine the strategic nature of role choices in terms of (a) why specific roles are chosen over others, and (b) the influence of roles on student perceptions and outcomes of collaboration. Roles were presented as a type of support students could utilize during their collaborative task. This study was divided into two parts. The first part examined what roles students chose during individual and group planning and why they chose those roles. Further analyses examined students' adaptation for role choices and their role reasoning at both the individual and group level. The second part examined the impact of group roles in (a) alleviating challenges groups face in collaborative tasks, and (b) how roles influenced students' perceptions of regulation. This discussion aims to highlight the major themes across research questions and provide suggestions for future research.

Part 1: Why do students choose specific roles?

The broad question of examining why students choose specific roles was carried out through examining both individual and group level data. In this instance, individual level data refers to students' individual planning about roles and their reflection on the collaborative experience. Group level data refers to the group's choices and reasons for the roles they planned to adopt.

Role choice across two collaborative tasks. Examining the roles students select for collaboration is important because these choices give insight about (a) what students perceive as important for supporting successful collaboration, and (b) how students and teams adapt choices for successive collaborative tasks. Three main themes emerged about

role choices in this study: (a) roles chosen by students and teams were well aligned with collaboration challenges reported in past literature, (b) role choices changed from Task 1 to 2, and (c) role choices changed from individual to group planning sessions.

Alignment of frequently chosen roles with challenges. The roles most frequently chosen during individual and group planning sessions included: (a) Task Wrangler which focused on time and strategy use, (b) Motivation Magician which focused on motivation within the group, and (c) SRL Word Wizard which focused on adequate and accurate use of course concepts. The high frequency of these role choices suggests students anticipate value in having these roles for collaborating, either due to anticipated challenges or preferences.

These three frequently chosen roles correspond with the most frequently anticipated challenges identified in past research (Hadwin, Bakhtiar, Webster, & Caird, in Progress). Hadwin et al., (In Progress) reported 13 different challenges were identified by 40% or more of the participants in their study as something students anticipated. Three of these challenges are closely related to the frequently chosen roles in the current study including unmotivated team members, ideas about organizing time, and what cognitive strategies they would use. Frequent choice of those three roles may indicate students anticipate them as challenges for their collaboration. Theory posits past experiences create conditions students draw upon when making decisions about collaboration (Winne & Hadwin, 1998; Hadwin et al., 2017). Conditions, such as past collaborations or beliefs about collaborating, may directly inform the choices students make about supports (roles) for collaboration being made. These conditions may guide or fuel role choices.

In contrast to the frequently chosen roles, students in the current study

infrequently chose the Climate Coach or the Planning Engineer role. The low frequency of the climate role being chosen is similar to findings from Hadwin et al.'s (In Progress) study indicating that group climate was rarely an anticipated challenge for students. This may be due to the absence of climate-related challenges in collaboration or a lack of anticipation for these challenges prior to collaboration.

Furthermore, the low frequency of students choosing the planning role may (planning engineer) may not be surprising as Miller, Malmberg, Järvelä, and Hadwin, (Submitted) found novice collaborators do not see the value in planning prior to beginning a task. Students may have seen less value in planning for the second task as they had already encountered a very similar task and may have chosen to focus on more salient roles.

Theories of SRL acknowledge challenges faced by students provoke strategic choices (i.e., choosing roles) (Winne & Hadwin, 2012). Findings from the current study suggest students may choose their roles based on challenges they anticipate prior to group work. To examine this, future research should include ratings of level of anticipated challenges that correspond to specific roles to examine alignment between anticipated challenges and role/support choices. Students may avoid choosing roles associated with certain anticipated challenges for fear of upsetting the group or feeling unprepared.

Findings in the current study revealed students often draw on knowledge about their personal strengths or knowledge (i.e., self-conditions) when making choices about roles. Few students reported they chose their specific role in relation to, or to address, a specific anticipated challenge. This may indicate learners are not regulating collectively, as they are not using challenges as opportunities to strategically respond as a group

(Järvelä, Jarvenoja, Malmberg & Hadwin, 2013. Roles chosen for Task 2 were very similar to the roles chosen for Task 1. This shows although these roles were utilized for Task 1, the roles were still important or valuable for Task 2. One explanation is these dominant challenges persist across successive tasks. Another explanation is students in this study did not collaborate over enough sessions to be able to draw upon and strategically respond to challenges salient to their group. A third explanation may be that students did not efficiently or effectively enact these roles to deal with the challenges they faced. Future research should examine role choices and explanations across a larger number of collaborative sessions extending over time to see if role choices shift more after having more time to respond to challenges.

Changes in role selections over successive tasks. Most individuals chose different roles or were assigned different roles for Task 2. This may be evidence of adaptive regulation; changes in role choice may occur in response to experience and knowledge gained through completing Task 1. Task 1 was the group's first opportunity to work together and decipher work and communication styles in addition to identifying group skills and salient challenges. The ability of the group to define strategies for future collaboration (e.g. choosing roles or reassigning roles) may be indicative of stronger regulatory skills (Järvelä et al., 2013). The changing of roles should be examined in a strategic context to see if the choices at Task 2 are based on evidence of experiencing these challenges during Task 1.

From a self-regulatory perspective, strategy choices in learning are not fixed, and successful students should adapt strategy choices to address self, task and group challenges encountered in the past (Butler & Winne, 1995; Winne & Hadwin, 2012). This

finding may be further elaborated by examining changes in role choice reasoning over time. The present study examined role choice over two tasks, however, collaboration is a complex process that takes time to learn and master (see Barron, 2000; 2003). Examining collaboration over more collaborative work sessions would create more opportunities for students to draw from past group experiences to make more strategic choices about supports. Specifically, future research should examine role choice over more than two subsequent collaborative tasks. Furthermore, in examining role choice over more successive tasks, patterns may emerge related to how students choose new roles or reassign roles from a previous task. There would also be potential to see how these role negotiations change across these tasks.

Flexibility of individual role choice. A majority of students selected a different role in group planning than the one they identified earlier in individual planning. While this is inevitable as multiple group members could identify the same roles as being the one they wanted to enact, it highlights the flexibility and adaptability of students in collaborative learning (Järvelä & Hadwin, 2013). Whether this is a promising finding or not, remains to be examined. One explanation is that productive group planning discussion promoted flexibility and adaptability in role choice. An alternate explanation is that students did not adequately share or provide a rationale for roles they personally felt were important for the team.

Evidence of change of student role reasoning across two successive tasks. Examining reasons for choosing particular roles is important because it provides critical information about how students perceive collaborative support and make decisions regarding that support. Two main themes emerged from the findings: (a) students used

different reasoning to make choices about roles together as team in comparison to during individual planning and (b) there is a change in the usage of each reasoning for Task 2.

Differing reasoning across group and individual planning. Specifically**,** when students selected roles during individual planning, they based those choices on information about the task or task context (task conditions), and information about themselves and their strengths and weaknesses (self-conditions). The individualized nature and the timing of the solo planner may have contributed to this finding. When students completed the Solo Planner for Task 1, they utilized information they had, the majority being information about themselves and the task, as they were unfamiliar with their group members.

When *groups* selected roles during group planning, they primarily based those choices on information about the task or task context (task conditions) or a combination of task information and information about their group and its members (group conditions). One explanation for this finding is during preliminary group discussions; individuals may have shared more information about themselves and how this contributes to their group dynamic. Future research should examine group planning discussions across multiple planning sessions to understand how and if role reasoning is shared and negotiated amongst group members. As group members collaborate together more times, they will learn more about each other and potentially shift towards more group-centric information. Research should also examine what leads to students changing their reasoning in future collaborative tasks, through examining performance, use of roles or other factors.

Evidence of reasoning changes across successive tasks. After the first task, most

students changed their role reasoning. Individual students primarily continued to use self or task reasoning or changed their reasoning to focus on self-conditions (such as personal beliefs or strengths). There are two potential explanations for this change in reasoning. First, students who changed their reasoning may be drawing on their first experience with their group to inform their decisions for Task 2. Through drawing on individual strengths and weaknesses, more informed choices could be made for their individual role choice. Second, students may be assuming greater personal responsibility for their contributions to collaboration. The reliance on information about themselves for Task 2 may reflect an acknowledgment that individual contributions and personal responsibility are essential to successful group work Research has shown that students are more likely to decrease effort the first time they collaborate (social loafing), which may be the case in this collaborative task (Bakhtiar, Hadwin, Milford, & Davis).

An alternative explanation for the emphasis on information about one's self is most of the participants in this study were first-year university students, with a majority still in late adolescence. Developmental research indicates that adolescents in that age group are still egocentric in their thinking and may neglect to think about people outside themselves (Schwartz, Maynard & Uzelac, 2008). An older participant group may draw upon different conditions when faced with making similar decisions. Examination of developmental differences in role reasoning could be an important area for future research.

In this study, groups changed their reasoning to draw upon more information about the group and past collaborations (group condition) and less information regarding their individual strengths or beliefs (self condition). This change may be attributed to it

being their second time collaborating together and having more knowledge about their group members. The decrease in drawing on task conditions to guide role choice may be due to groups focusing more on collaborating and overcoming challenges and focusing less on task components and constraints as they have already completed a similar task with the same group members. Hadwin, Järvelä, and Miller (2017) posited group conditions are informed by observing the current group. This was supported by the observed increase in group-related reasonings at Task 2, as students should have increased their knowledge about the group during Task 1.

As seen in this study, many students expressed role choice reasoning rooted in conditions surrounding the task itself (task conditions). These students were focused on task information, rather than individual or group knowledge and strengths. It may be valuable to support students in considering a more cohesive overview of the group and the task and utilizing more conditions to make more informed decisions.

Overall conclusions of role choice. The findings from Part 1 of this study highlight that students make similar decisions about roles across two successive tasks, but that the reasons of these choices tend to change. Considering these two pieces of information together, highlights the importance of providing multiple opportunities for students to build and expand their skills within a collaborative context for learning.

Part 2: Do roles improve collaboration?

To examine the broad impact of roles on collaboration, three sub-questions were examined to see how roles influenced experience of challenges, self- and shared-regulation of learning, and how actually using those roles impacted individual's beliefs.

Performance in the face of challenges. The majority of current research on roles

examined roles in relation to academic success or task progress (see Strijbos, 2004). However, roles have proven to be beneficial to students with increased task engagement and higher performance or outcome scores (De Wever et al., 2007; Strijbos et al., 2004). Overall, roles have had promising outcomes in previous research, and have demonstrated promising findings for further supporting regulation. Regulation of learning aims to support learning processes across tasks and challenges instead of targeting specific instances of learning (Hadwin & Winne, 2012).

In the present study, students perceived that their group performed similarly in response to challenges whether their group had the associated role or not. Findings of a positive relationship between ratings for role-related and non-role related challenges indicated some consistency in ratings of role-related and non-role related challenges. This finding was inconsistent with the hypothesis that an inverse relationship would exist between challenges targeted by selected roles and challenges targeted by not-selected roles. There are two possible explanations for this finding.

First, simply choosing roles and having access to role information may have supported regulation in response to challenges as a whole rather than supporting regulation in response to one specific subset of challenges. This would lead to encountering similar severity across all challenges, rather than specifically decreasing ones corresponding with roles. This could be due to the social nature of these roles, which promoted discussion within the group and ultimately aimed to increase metacognitive awareness across challenges. This finding may emphasize the need to have more social-driven supports for learnings (Miller, 2015). Future research should compare differences the challenges encountered between groups that have access to goals and

groups that do not.

Second, it is possible that differences in challenge experiences were not reported because roles were chosen but not really enacted during collaboration. Future research should examine traces of collaborative activity and discussions for evidence that roles were actually used to shape collaborative processes and outcomes.

In the current study, all students were provided with the same scripting, and the majority of students rated themselves as performing well across all the various challenge categories. The scripting of the task may have led to minimal differences in challenge experiences. For example, in Hadwin et al. (in Progress) students in low scripting conditions reported more challenges than students in the highly scripted condition. This could be further examined by using group roles in a less scripted way to see if this impacts the groups' performance when faced with challenges. Furthermore, future research should more closely examine students' experiences of challenges in relation to the roles they are choosing or not choosing. Finally, since the current study grouped challenges together for rating, some of the finer details may have been blurred from the challenges students experienced.

Influence of roles on self and shared regulation. In examining students' perceptions of regulation across two collaborative tasks, several findings were illuminated. First, students reported more individual focused regulation at Task 2. A significant difference was highlighted for students' regulation in their own roles, as students moved towards more individual focused regulation. These findings suggest students began to take more responsibility for their learning and their contributions to collaboration. The explanation for this finding may be similar to the phenomenon

discussed earlier, social loafing (Bakhtiar et al., In Review). In the current context, for Task 1, students collaborated for the first time and may believe they can rely more on their group than they should, thus resulting in scores representing more shared regulation. Bakhtiar et al., (In Review) identified that students collaborating together for the first time had higher beliefs in their group member's ability to contribute than when they collaborated together for the second time.

Influence of role usage on perceptions of self and shared regulation. Individual students who reported more regular role use during collaboration also reported slightly more individually focused regulation for the role for which they were responsible. This finding suggests using support (roles) throughout a collaborative task may be beneficial to students rather than having a support introduced for only one portion of a task. Having students enact roles throughout the task, as opposed to one portion, may be more supportive of regulation. Research by Miller & Hadwin (2015) identified implementation of a support (scripting) in the planning phase of a collaborative task did not have lasting impact throughout the remainder of the task. Research on scripting and group roles has highlighted the value of having these supports in place versus having no structure in collaborative learning (see Weinberger et al., 2007; Schellens et al., 2007). Future research should examine the effects of having roles earlier on in the task planning. Furthermore, it would be important to examine if students are accurately self-reporting their usage of roles, or if they believe they have enacted their role regularly due to the success of their group (i.e., fewer challenges).

Overall impact of roles. Overall findings suggest roles have promising impact on students' self-perceptions and experience throughout collaboration. While this study was

exploratory, there are several avenues that future research can explore to investigate the effectiveness of roles for support student's regulatory processes and decreasing their experience of challenges.

Limitations

Although this study contributes important findings, at least 8 possible limitations should be considered.

First, participants in this study were required to choose between seven possible roles for collaboration: motivation magician, SRL word wizard, task wrangler, climate coach, planning engineer, participation promoter and communication coordinator. This limitation may have forced students to make choices regarding roles they did not find valuable. It is possible that a broader selection of roles may have afforded opportunities for individuals and teams to address a wider array of potential challenges.

Second, while three group sizes existed in this study (five, four, or three members), the majority of the groups were four people leaving too few groups of five or three students for a meaningful analysis to examine the effect of group size. Also at the group level, it is difficult to know the extent to which each group member contributed to group planning and role choices. Although there is a chat log, the majority of groups had one person complete all the editing on the wiki page. Group sizes may have had an impact on the choices, reasonings or effectiveness of roles. Larger groups had more roles to utilize within the group, but smaller groups would have had to be more concise in the choices they made. Future research should examine group size with a larger selection of groups to compare amongst, to see if different group sizes make different choices about roles.

Third, this study was completed under the assumption that students actually utilized roles to some degree in the collaborative task and that they all had similar understandings of the roles. However, some students may not have used the roles at all, or may have enacted roles they were not formally assigned. Furthermore, students may have interpreted the roles in different ways, leading to different outcomes. Future research should examine trace data, such as chat logs, from the collaborative tasks for evidence of role use. Through analyzing chat data, it will also highlight the degree to which groups were regulating together throughout the task.

Fourth, condensing qualitative codes of goal reasoning into bigger categories may have masked some of the finer granularity the full coding scheme attempted to capture. For example, one student's reasoning for their choice was "Our group ranked this as very important, and I believe that I would be successful in guiding feedback." This originally fell under near self and group information, however, was condensed to just group as the salient feature was that they were acknowledging group beliefs. This was a necessary step to examine the impact of reasoning in the current study due to the small sample size. Future research should utilize a bigger sample, so there is more distribution of the coding scheme, and more fine-grained patterns can be recognized.

Fifth, this study drew heavily from self-report data across multiple data sources, including the measure of students' perceptions of regulation and their experience of challenges (see collaborative self-assessment). A strength of self-report data for this type of research is students can report on authentic learning situations. A limitation is that students may report more "desirable" outcomes when responding to scales relating to experienced challenges. This may have contributed to the skew of the challenges data, as

past research has indicated not all students are high social regulators in collaboration and that collaboration is challenging. Future research should examine chat logs for evidence of regulation or experiences of challenges.

Sixth, the data in this study was complex, as several data sources (e.g., collaborative self-assessment) were addressed as individual data, but these data sources were in relation to group level phenomenon. This may have influenced the interpretation of the findings, as they may be more complicated and intertwined than the analyses revealed. Future studies should investigate similar data with multi-level analyses to see how the relationship between the two levels of data intertwine.

Seventh, the primary investigator for this study was also a lab instructor for the course. A strength was that it provided instructional insight when coding and interpreting complex and highly contextualized written responses. Without this contextualized understanding, some data may have been difficult to interpret in valid and reliable ways. However, a limitation is that I may have read more into student responses than was actually intended. Future studies can involve more independent rater analyses to examine if similar conclusions are drawn.

Finally, this study was constrained to one first-year undergraduate course that emphasized learning processes and metacognitive awareness. Students enrolled in this course may be fundamentally different from students in other undergraduate courses who have not been exposed to these concepts. Having knowledge of these concepts may have made students more aware of the challenges they faced in collaboration, changing the potential impact of using roles. Furthermore, findings are limited to undergraduate students enrolled in a first year university course and may not be generalizable to other

professional and community-based collaborative task contexts.. Therefore, executing a similar study in a different course or in a corporate atmosphere would be valuable to see if responses change, especially when analyzing reasons.

Contributions to Research, Theory, and Practice

Although this study had several limitations, it also offers valuable contributions to research, theory, and practice. As collaborative learning has become increasingly important in 21st-century learning, this research has potential to have impact on research, theory, and practice.

This exploratory study provides a platform for future group role research. While role choice distribution across individual planning and group planning was similar, students' willingness to take on a role different than the one they chose in individual planning provides support for exploring future interventions for students in collaborative learning. This willingness indicated that students are adaptive based on their experiences, which an important phase of SRL (Winne & Hadwin, 1998). Whether it is through prompting or guiding, students have potential to make strategic choice about how to best support their groups for collaboration.

Future opportunities also exist for scripting and prompting students to think about the different information about self, task, and group (conditions) that might influence strategic decisions in collaboration. This study found that students primarily drew on information about themselves or information about the task when making strategic decisions about role choices. There may be benefits in prompting students to draw from multiple conditions, or sources of information when making choices among strategic supports. Examining scripting that sets up students to critically evaluate the three types of

conditions (self, group, and task) would set students up to make more informed decisions. Findings from this study lend support for Hadwin et al., (2017) model of regulation in collaborative learning contexts that posits three kinds of conditions inform regulatory decisions and choices including self, group, and task conditions. When role choice reasoning was coded, we found a strong fit between open-ended explanations of role choice provided by students, and the three types of conditions proposed by Hadwin et al. (2017) This study contributes further to that model by identifying the potential intersection of the three conditions acknowledging that students draw from multiple types of condition information when making strategic decisions in collaboration. This provides valuable information to support further examination of the COPES model, primarily regarding collaborative contexts. The Winne and Hadwin (1998) model of SRL was originally targeted towards individuals in their learning but has since been extended to the collective level (Hadwin et al., 2011). This study provides support for the micro level processes occurring in both individual and collective regulation of learning.

This study contributes to practice by providing educators insight into what students perceive as important for collaboration, as well as what areas students are identifying as focus areas for collaborative learning. Educators can also benefit from implementing roles in a task, as roles appear promising for mediating and alleviating the occurrence of challenges in collaborative students. The roles utilized in this study were not task driven and could be adopted in various contexts and tasks for educators to utilize and adapt as needed. Findings suggested challenges may persist after the first collaborative task, giving insight to educators to implement different supports over time.

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Appendix A
Role Sheet

Participation Promoter

About Roles

Each student in your group has one role. This means that during the collaborative challenge you will have 2 main jobs:

1. Contribute to discussing and solving the ACT1 task, and
2. Execute your ROLE by monitoring, evaluating, and prompting your team into action when appropriate.

As the Participation promoter

It is your job to encourage and maintain participation, shared workload, distribution of contributions and use of individual strengths during the ACT1 activity. You should monitor levels of participation and prompt and encourage your group when appropriate.

Questions a Participation Promoter thinks about

- Are we sharing the workload?
- Is everyone contributing?
- Are we working to the same level or standard?
- Is everyone bringing their strengths to the discussion?

Preparing for your role

In the right column you will find a place to record your name and create some prompts, sentence starters or cheers you can remember to use during the chat. If you take the time to prepare for this role, it will be much easier to do this. We have provided some example prompts and cheers to get you started.

What to do with this role sheet

Each group member will upload their role sheet to the group planning wiki once it is complete. If you want to print a copy of this page to put on the desk beside you during ACT1, you can do that.

Who is doing this role?

Prompts & Cheers

Do you have anything to add [NAME]?

What do you think [NAME]?

We need to hear from everyone.

Anything to add?

Let's all try to contribute something to the answers!

My own prompts:

Appendix B
Solo Planner

Thinking About Roles in Collaboration

Given that there are more roles to support productivity and success of your group than there are students in your group for ACT1, what level of priority do you place on having someone in each of the following roles during the ACT1 task:

1. Motivation Magician

This person's job is to monitor, prompt, guide and redirect things related to confidence, attitude and commitment. This person focuses on things like:

Are we all committed to the task?
Are we all approaching the task with positive attitude?
Are we focusing our effort on things in our control?

Not a Priority — High Priority

Briefly explain why you rated as above:

Type here

Appendix C
Group Planner

Part 2: Collaboration Roles

This **Role Summary chart** displays the average ratings of priority your group assigned (see number in the middle of the meter). Red meters indicate you thought this was a high priority, Green meters indicate you thought this was a low priority. Orange meters indicate you thought it was a moderate priority. Brief descriptions of each role follow in case you can't remember.

Motivation Magician: *This person's job is to monitor, prompt, guide and redirect things related to confidence, attitude and commitment.*

SRL Word Wizard: *This person's job is to monitor, prompt, guide and redirect things related to appropriate and distributed use of course concepts for the task*

Task Wrangler: *This person's job is to monitor, prompt, guide and redirect thing time management, task approaches, and task standards.*

Climate Coach: *This person's job is to monitor, prompt, guide and redirect things related to group trust, conflict management and create a welcoming space for differing ideas and perspectives.*

Planning Engineer: *This person's job is to monitor, prompt, guide and redirect things related to roles, checking progress, and revising plans.*

Participation Promoter: *This person's job is to monitor, prompt, guide and redirect things related to sharing the workload, monitoring contribution distribution and utilizing strengths within the team.*

Communication Coordinator: *This person's job is to monitor, prompt, guide and redirect things related to prompting feedback, working through language differences and encouraging active listening within the group.*

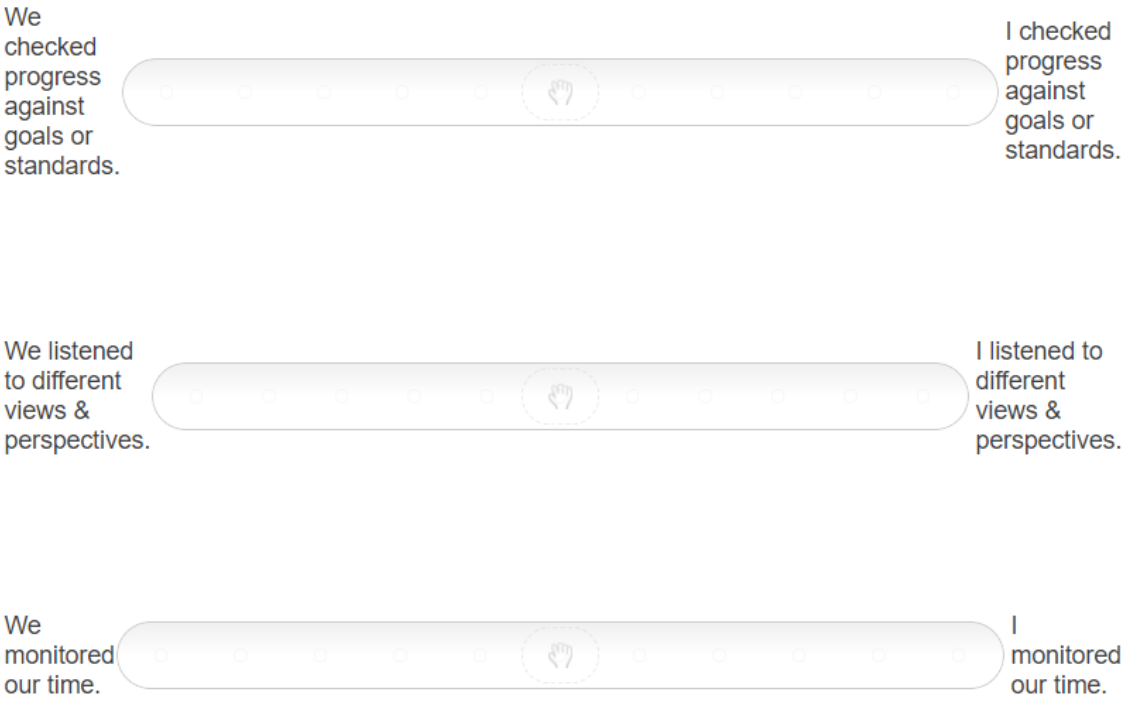
2.1) Use this Role Summary chart to guide your discussions about what roles you will take on for ACT 1. Each person in your group can take on one role only! If there are 4 people in your group, you can cover 4 roles. If there are 5 people in your group, you can cover 5 roles.

Collaborative Roles	Indicate the roles you will use (X) for ACT1 (1 per person)	Who will take on this role?	Why are we choosing this role?
Motivation Magician			
SRL Word Wizard			
Task Wrangler			
Climate Coach			
Planning Engineer			
Participation Promoter			
Communication Coordinator			

2.2) Open the Tip sheet (below) for the role you have been assigned. Each person in your group should open one tip sheet. The tip sheet gives you lots of

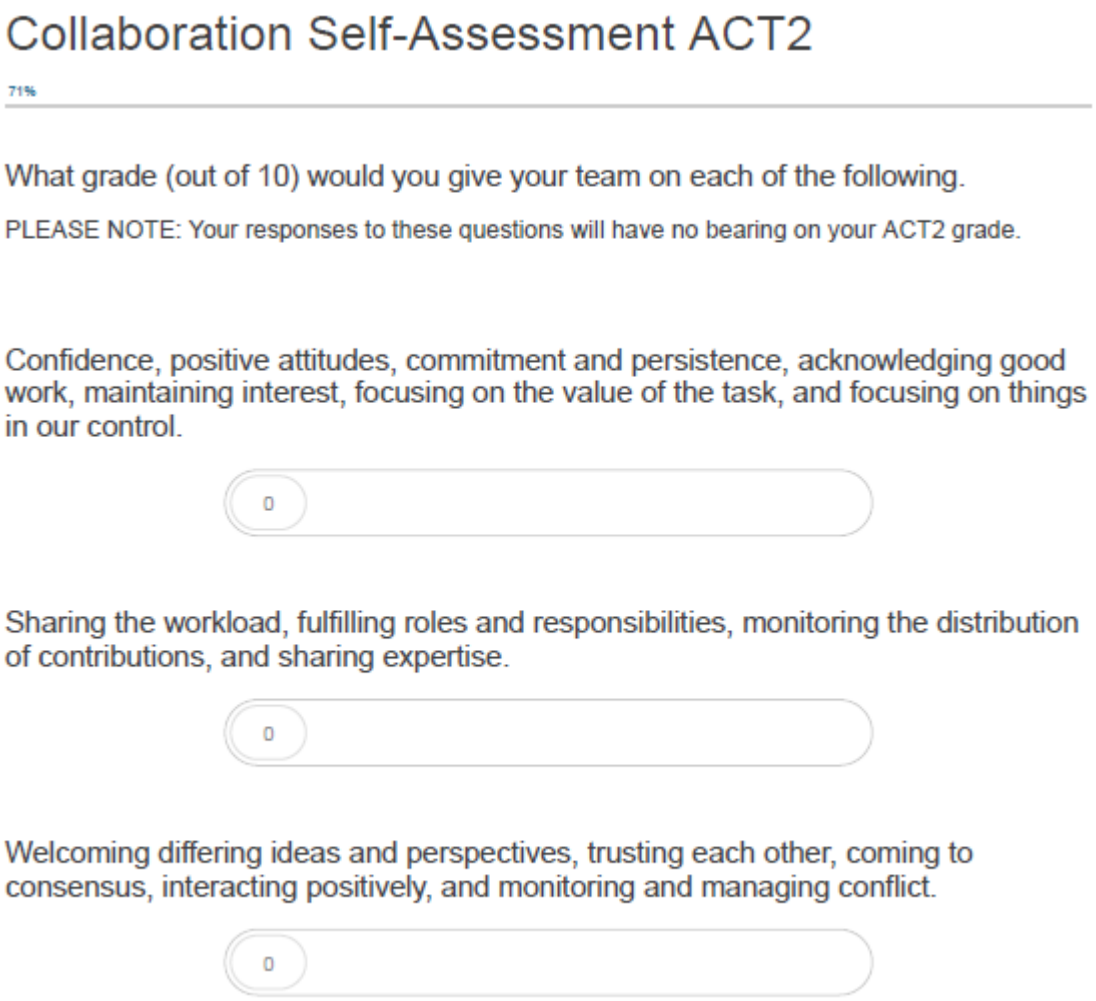
Appendix D

Collaborative Self-Assessment Regulation Rating



Appendix E

Collaborative Self-Assessment Challenge Rating



Collaboration Self-Assessment ACT2

71%

What grade (out of 10) would you give your team on each of the following.

PLEASE NOTE: Your responses to these questions will have no bearing on your ACT2 grade.

Confidence, positive attitudes, commitment and persistence, acknowledging good work, maintaining interest, focusing on the value of the task, and focusing on things in our control.

0

Sharing the workload, fulfilling roles and responsibilities, monitoring the distribution of contributions, and sharing expertise.

0

Welcoming differing ideas and perspectives, trusting each other, coming to consensus, interacting positively, and monitoring and managing conflict.

0

Appendix F

Ethics Certificate

University of Victoria

Office of Research Services | Human Research Ethics Board
Michael Williams Building Rm B202 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-4545 | F 250-721-8960 | ethics@uvic.ca | uvic.ca/research |

Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR:	**Allyson Hadwin**	**ETHICS PROTOCOL NUMBER:**	**08-07-308b**
UVic STATUS:	**Faculty**	ORIGINAL APPROVAL DATE:	20-Jun-08
UVic DEPARTMENT:	**EPLS**	RENEWED ON:	19-Jun-17
		APPROVAL EXPIRY DATE:	19-Jun-18

PROJECT TITLE: **PAR-21: Promoting Adaptive Regulation for the 21st Century**

RESEARCH TEAM MEMBER: Co-PI: Dr. Phil Winne (SFU); Collaborators: Dr. Sännä Jarvela (U of Oulu), Dr. Paul Kirschner (Open University of Netherlands), Dr. Margaret-Anne Storey (UVic), Dr. Peter Wild (UVic), Dr. Daniel Dinsmore (UNF), Dr. Meghan Parkinson (UNF), Dr. Lindsay McCardle (U of Ottawa), Dr. Mariel Miller (UVic), Dr. Todd Milford (UVic); Graduate Students/Research Assistants (UVic): Elizabeth Webster, Aishah Bakhtiar, Rebecca Edwards, Shayla Starcheski, Yushu Huang, Sarah Davis, Priyanka Sharma, Natalie Usher

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CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

Dr. Rachael Scarth
Associate Vice-President Research Operations

Certificate Issued On: 19-Jun-17

08-07-308b Hadwin, Allyson