

# Self-regulated learning in and across sport and academic domains

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M.A., University of Ottawa, 2008

B.A., University of Ottawa, 2006

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## Supervisory Committee

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Dr. Philip Winne, Departmental Member (Educational Psychology and Leadership Studies)

Dr. Geraldine Van Gyn, Outside Member (Exercise Science, Physical and Health Education)

## Abstract

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SRL has been posited to explain student-athletes concurrent success in sport and academics. The purpose of this dissertation was to empirically explore student-athletes' self-regulated learning (SRL) in and across their academic and sport learning. Three manuscripts addressed two overarching goals: (a) explore the relation between SRL in sports and academics, and (b) explore methods of measuring SRL. First, in McCardle, Jonker, Elferink-Gemser, and Visscher's (2014) study, competitive youth athletes ( $N = 215$ ) self-reported on self-regulatory and motivational engagement in sport and academics. Findings revealed a positive relation between SRL in these contexts and more reported engagement of SRL in sports than in school. Second, McCardle (2014) conducted a case study of one student-athlete's SRL in sport and school. Based on interviews, journals, and video-stimulated recall, the student-athlete demonstrated clear similarities in how he engaged SRL in both contexts. Some differences between sport and academic learning emerged, suggesting potential differences in support for SRL in the two contexts. This paper explored potential of qualitative measures of SRL in by combining multiple qualitative measures of SRL to create SRL profiles in sport and academics. Third, McCardle and Hadwin (2015) explored use of two types of self-reports considered event measures of SRL as they focused on single learning episodes ( $N = 263$ ): (a) a quantitative questionnaire measure of SRL related to one study episode for an exam, and (b) a qualitative diary related to setting and attainment of one study goal. Contrasting these two methods revealed varying degrees of

similarities in students' self-reports. Together, this research highlights the potential of transfer of SRL across sport and academic domains and the importance of appropriate measures to capture event- and aptitude-based SRL and suggests several avenues for future research. To conclude, I suggest Winne and Hadwin's (1998) model of SRL serve as a framework for researching SRL transfer with a focus on conditions. New research in transfer has potential for contributing to SRL research on how learners draw on previous regulatory experiences to adapt to new challenges.

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## List of Original Articles

1. McCardle, L., Jonker, L., Elferink-Gemser, M. T., & Visscher, C. C. (2014). *Self-regulated learning in sport and academic domains for competitive youth athletes*. Manuscript in submission (one round of review, re-submitted).
2. McCardle, L. & Hadwin, A. F. (2015). Using multiple, contextualized data sources to measure learners' perceptions of their self-regulated learning. *Metacognition and Learning*. doi: 10.1007/s11409-014-9132-0 (three rounds of reviews).
3. McCardle, L. (2014). *Similarities and differences in self-regulated learning processes in sport and academics: A case study*. Manuscript in submission (one round of review, re-submitted).

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Excellence is never an accident. It is always the result of high intention, sincere effort and intelligent execution; it represents the wise choice of many alternatives - choice, not chance, determines your destiny.

Aristotle

## **More than kips and cartwheels? Introduction to SRL across sport and academic domains**

In popular media, athletes are often considered “not the brightest bulbs in the collegiate lamp” (Brand, 2008). Some researchers have suggested student-athletes struggle to devote time to academics (Parham, 1993) and underachieve in academic contexts. Athletes do spend a considerable amount of time in training and related activities (Watt & Moore, 2001): 8-30 hours a week reported for adolescent German athletes (Brettschneider, 1999), and up to 43 hours a week for Division I men’s football players (National Collegiate Athletics Association [NCAA], 2011a). Student-athletes at NCAA schools report missing up to 2.5 classes per week. However, research has demonstrated athletes succeed not only on the playing field but in the classroom as well (Aries, McCarthy, Salovey, & Banaji, 2004). Durand-Bush and Salmela (2002) described the World and Olympic champions they interviewed as “high achievers in both sport and school” (p.165).

Some research has found athletes’ academic performance equals their non-athlete counterparts. Aries et al. (2004) and Richards and Aries (1999) reported athletes entered university with lower SAT scores, particularly on the verbal SAT. However, athletes’ GPA did not differ from non-athletes when matched for demographic variables and SAT scores. This held true for both male and female athletes. Graduation rates reported by the NCAA (2011b) show for the 2004 entering class, athletes graduated at rates comparable to non-athletes (65% to 63%, respectively), though rates vary by sport and by gender (e.g., men’s football: 64%; women’s lacrosse: 94%). Data from previous years reported by Watt and Moore (2001) also suggested athletes graduate at similar rates as non-athletes: 58% for athletes compared with 56% for non-athletes at Division I schools. Umbach, Palmer, Kuh,

and Hannah (2006) found athletes at all Division levels of college athletics self-reported similar levels of engagement in “educationally purposeful activities” (p.78) as their non-athlete peers. This included active and collaborative learning, student-faculty interactions, and perceived challenge level of academic learning.

In addition, research underscores the educational and developmental benefits of participating in school-based extracurricular activities for high school students, of which sports are the most popular (Feldman & Matjasko, 2005). In a review of literature on school-based activity participation, Feldman and Matjasko (2005) concluded sport participation is positively related to school outcomes, such as academic achievement, educational aspirations, and continued enrollment. S. Hanson and Kraus (1998) reported that for senior high school females being involved in sports had a positive impact on both access to and attitudes toward science. Sports participation has been linked to higher grades, more time spent on homework, and higher educational aspirations (Broh, 2002; Fredericks & Eccles, 2006; Marsh & Kleitman, 2003). Involvement in sport in grades 10 and 12 significantly predicted enrollment in university and educational aspirations one year after high school (Fredericks & Eccles, 2006; Marsh & Kleitman, 2003).

Outside of the United States, research also suggests athletes excel academically compared to non-athletes. Richartz and Brettschneider (cited in Brettschneider, 1999) reported German adolescent athletes had higher grades in German language and mathematics class as well as higher levels of intent to attend university than non-athletes. Jonker, Elferink-Gemser, and Visscher (2009) examined Dutch high school student-athletes compared to the national average. In the Dutch secondary education system, the attained level of education, pre-university or pre-vocational, is the “most important predictor for

academic prospects” (p.57). In the 2006/2007 year, the percentage of athletes registered in pre-university level was significantly higher than the national average percentage of students in pre-university level. In another sample, elite level soccer players were also more likely to be enrolled in pre-university level than age-matched controls (Jonker, Elferink-Gemser, Toering, Lyons, & Visscher, 2010).

### **Explaining Athletes’ Academic and Athletic Successes**

Most research suggests athletes succeed in academics at levels equal to or greater than their non-athlete peers despite committing large amounts of time to training in their sport. Is there something about sports that helps to promote academic success? Marsh (1992) proposed one potential explanation by suggesting benefits are due to enhancement of school identity, involvement, and commitment. Marsh proposed an increased sense of academic self-concept mediates the relation between extracurricular activity participation and beneficial academic outcomes. Eccles and Barber (1999) provided another potential explanation, suggesting students benefit from extracurricular activity participation, including sports, due to engagement in a social network that affects identity. Adolescents’ activity choices directly influence with whom they spend time and with whom they are likely to develop friendships. Values and norms of friendship networks are proposed to influence students’ behaviours and attitudes, which influence academic outcomes (Eccles & Barber, 1999).

The theories posited by Eccles and Barber (1999) and Marsh (1992) are limited by a focus on extracurricular activity in general, spanning several types of activities including academic clubs, school government, and band, in addition to sport. The research related to these theories has not distinguished between competitive and recreational levels of sport

participation (e.g., Feldman & Matjasko, 2005). However much of the research on athlete success in school has focused on competitive athletes, often considered “elite” level athletes in their sport (e.g., varsity athletes in college). Further, for European athletes, their sport participation is not usually school-based, suggesting there maybe something more than school identity and friendship networks impacting academic performance.

My own experiences in competitive sports have continually led me to question whether these explanations focused on identity and friendships are sufficient to capture the kind of learning that guides performance across these two dramatically different contexts. For example, I spent eight years as a competitive gymnast and ten years as a coach. Throughout this time, I observed that what I was learning as an athlete and teaching as a coach extended well beyond the domain of gymnastics. Technique and talent are not enough to succeed as a competitive gymnast. Gymnasts learn that persevering through challenges, committing to personal progress, viewing failures as opportunities, and dedicating one’s best effort to finding effective strategies contribute to success in sport. Not only are these motivational attributes associated with self-regulated learning (SRL), but they also are critical life skills. During my Master’s research examining self-observation and sport performance I began to consider whether the development of SRL in sport might be a critical factor contributing to the success of athletes in academic contexts.

The idea that SRL might link sport and academic learning has recently been gaining ground in the literature (cf., Jonker et al., 2009). However, the reverse is also plausible: SRL processes might transfer from academics to sport. Zimmerman (1998) claimed there “is extensive anecdotal evidence that similar self-regulatory processes are used across such disciplines as music, sports, and writing by seasoned learners” (p.84). Emerging research

establishes a link between success in academics and sports as athletes report higher engagement of SRL than non-athletes (Jonker et al., 2010). However to my knowledge, no research has examined the self-regulatory processes of student-athletes in both their academic learning and sport training contexts.

The purpose of this dissertation research was to empirically explore student-athletes' SRL in and across their academic and sports learning. The empirical work of this dissertation consists of three manuscripts; as such, the dissertation is presented in two main parts. Part 1 presents theoretical frameworks of SRL and transfer; explores methodological considerations relevant for this program of research; overviews the purpose and connections between the three published manuscripts; and provides a discussion pulling together conclusions, limitations, and future directions for this program of research. Part 2 consists of three published (or submitted) manuscripts that comprise the substance of the empirical dissertation work.

### **The COPES Model of SRL: Theoretical Framework**

Self-regulation has been variably defined in different fields of psychology (Vancouver & D. Day, 2005). Because the focus of this dissertation is on SRL in sports and academics, I look particularly to sport and educational psychology literatures to define SRL. Within the sport psychology literature, the term used has been self-regulation and this has been defined as athletes' control and adaptation of behaviour, cognitions, and emotions in goal-oriented pursuits (Cleary & Zimmerman, 2001; Toering, Elferink-Gemser, Jordet, & Visscher, 2009; Young & Starkes, 2006a, 2006b; Zimmerman & Kitsantas, 1996). While most definitions do not emphasize metacognition specifically, researchers do include regulation of cognition as part of self-regulation. Further, the focus on mental training for sports performance (e.g., Hall, 2001; Tod, Hardy, & Oliver, 2011) highlights the importance of cognition in physical performances. Several definitions of self-regulation in sport emphasize the absence of external constraints (Anshel & Porter, 1996a, 1996b; Gano-Overway, 2008; Kirschenbaum, 1987; Young, Medic, & Starkes, 2009) implying self-regulation is only expected to occur when athletes are training alone.

The term self-regulated learning has been used widely within educational psychology to specifically refer to self-regulation in academic domains with a broad focus on interactions between cognition, motivation, and the environment (Dinsmore, Alexander, & Loughlin, 2008). SRL is defined as planning, monitoring, and adapting that learners direct towards goal achievement (Hadwin & Winne, 2011; Schunk & Zimmerman, 1997; Winne, 1997, 2001; Winne & Hadwin, 1998; Zeidner, Boekaerts, & Pintrich, 2000; Zimmerman, 1989). Almost all definitions of SRL in educational psychology explicitly incorporate metacognition (Dinsmore et al., 2008), which refers to monitoring and control of cognition

(Flavell, 1979). Research on SRL has spanned independent studying as well as learning within classrooms that include external constraints. It has been argued self-regulation is ubiquitous, occurring to some extent in all learning (Winne, 1995b). SRL is differentiated from self-directed learning, which is a term used often in relation to adult education referring to selections of content for learning that are initiated by the learner (Beishuizen & Steffens, 2011; Merriam, 2001). Thus, even when learning is not self-directed, some SRL theorists expect learners to regulate.

Drawing on sport and educational psychology literatures, I use the term self-regulated learning to emphasize that despite different end goals (physical performance and cognitive change) both athletes and students are engaged in setting goals, monitoring, and adapting and refining learning processes. Therefore, I define SRL as learners' active engagement of processes to control and adapt cognition, behaviour, and motivation/affect to reach self-set goals (Winne & Hadwin, 1998, 2008; Zimmerman, 1989, 2000). In this view, metacognitive monitoring and metacognitive evaluating are key processes used by self-regulated learners to adapt, experiment, and persist with learning (Hadwin & Winne, 2011; Schunk & Zimmerman, 1997; Winne, 1997, 2001; Winne & Hadwin, 1998; Zeidner et al., 2000; Zimmerman, 1989). I maintain SRL occurs in the presence of external constraints, such as athletic practice directed by a coach or classroom learning directed by a teacher, as well as in self-directed activities, as when an athlete executes a solo practice session. While it is clear varying levels of independent practice and studying are part of learning and that SRL is crucial in these circumstances, external constraints do not preclude the use of SRL processes. For example, a coach may prescribe a certain number of sets of 50m freestyle swimming with a focus on hand positioning throughout, thereby constraining what athletes

work on, but athletes still have much to regulate in terms of motivation, cognition, and behaviour. Athletes may choose to focus on a specific form element or may choose to just complete the lengths without really focusing at all.

### **Models of SRL and Connections Between Sports and Academics**

Models of SRL incorporate motivation, cognition, and behaviour making them well suited to explain academic studying, a process usually left for students to navigate on their own (Zimmerman, 1998), and sport training, in which deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993) has been given a central role (Baker & Young, 2014). Numerous models have been proposed to explain how learners regulate in both academic (e.g., Boekaerts, 1995; Pintrich, 2004) and sport tasks (e.g., Kirschenbaum, 1984).

To my knowledge, Zimmerman's (1998, 2000) tri-phasic model is the only model that has been used in both academic settings (e.g., Kitsantas, 2002) and sport settings (e.g., Cleary, Zimmerman, & Keating, 2006). Based on Bandura's (1986) social cognitive theory, Zimmerman proposed learners adjust their thoughts and affect (covert person), their behaviour, and their environment. Regulation occurs in a cycle of three phases based on processes occurring before, during, and after the task. Zimmerman labels the first phase *forethought*. This phase includes (a) task analysis, which refers to the processes of goal setting and planning; and (b) self-motivation beliefs, which include self-efficacy, outcome expectations, intrinsic interest, and learning goal orientation. The second phase is the *performance* phase. In this phase learners engage strategies for (a) self-control, such as using imagery, self-instruction, focusing attention, and task strategies; and (b) self-observation, including self-recording of performance aspects, and self-experimentation. The final phase, *self-reflection*, occurs after the task. The self-reflection phase includes (a) self-judgment,

such as self-evaluation and making causal attributions for outcomes; and (b) self-reaction, such as self-satisfaction and affective reactions, as well as adaptive or defensive inferences in looking forward to future performances. These phases are cyclical in that self-reflections based on one learning occasion impact forethought processes for subsequent attempts.

Winne and Hadwin (1998) offered another prominent model of SRL in studying. They proposed SRL unfolds over four, loosely sequenced phases. In Phase 1, *task perceptions*, learners construct a personal, internal definition of the task at hand. Guided by their task perceptions, learners create standards for their work and choose how to accomplish it in Phase 2, *goal setting and planning*. Phase 3, *task enactment*, involves engaging the decided-upon tactics and strategies to complete the task or work towards the goal. Phase 4, *adaptation*, is optional. In this phase, learners make large-scale adaptations to task perceptions, goals and plans, and/or tactics and strategies. Phase 4 is especially critical when learners face challenges (Hadwin, Järvelä, & M. Miller, 2011) because challenges imply learners need to modify something in their approach to reach the goals they have set. Further, while SRL processes can be automated, these processes become deliberate when difficulties arise (Winne, 1995b).

To further describe how learners navigate within and between phases, Winne (1997; Winne and Hadwin, 1998) proposed a cognitive architecture, known by the acronym COPES (conditions, operations, products, evaluations and standards). *Conditions* are factors perceived by learners that surround their work. These include internal factors such as metacognitive knowledge, beliefs about the nature of knowledge, and motivational beliefs, such as self-efficacy. Conditions also include learners' perceptions of external factors such as resources, social context, and time. The inclusion of external factors allows for learning to

be situated; that is, learning occurs within and is dependent on the context. *Operations* are the cognitive work that is done on tasks, such as searching for strategies, rehearsing information to encode it, or translating information. The operations engaged in each phase create different *products*: task perceptions, goals and plans, traces of tactics and strategies, and adaptations. Products are conditions for subsequent phases, so that learners' task perceptions guide goal setting and goals influence the choice of tactics. Products are *evaluated* against learners' *standards*. That is, learners are not just judging their overall performance, but they are also evaluating the product of each phase. Winne and Hadwin suggested learners have multiple standards against which they evaluate products. The model is recursive as products from one phase and one task influence future phases and tasks.

Metacognitive monitoring and control processes play critical roles in SRL by identifying occasions for change. Monitoring can occur at the macro-level in terms of monitoring performance and progress towards learners' goals and at the micro-level in terms of evaluating the products of or within each phase and judging whether adaptations, immediate or in the future, are necessary. Metacognitive control leads to adaptations in *conditions, operations, and/or standards*, which can effect change in the products for any phase and how these are evaluated. Without self-awareness of both process and progress relative to goals, learners are oblivious to the need to regulate. As Bandura (1982) stated, "People cannot affect the direction of their actions if they are inattentive to relevant aspects of their behavior" (p. 6).

An important distinction in models of SRL is between goal orientation and goal setting. Goal orientation can be described as a "trait-like" construct and is usually measured as a general disposition (e.g., Seijts, Latham, Tasa, & Latham, 2004). In Winne and

Hadwin's (1998) model, goal orientation operates as a condition in COPEs and in Zimmerman's (2000), as a self-belief in the forethought phase. Goal setting, on the other hand, is the "state-like" construct that refers to the desire to attain a specific standard in a task (Locke & Latham, 2006). In SRL, goals arise in the second phase of Winne and Hadwin's model and have three functions: (a) providing a context for interpreting tasks (Phase 1), (b) directing tactic and strategy choice for task enactment (Phase 3), and (c) providing large-scale standards for monitoring and evaluating performance and progress (Winne & Hadwin, 1998; McCardle, Webster, & Hadwin, 2012). This illustrates the flexible sequencing of their model.

Though on the surface Winne and Hadwin's (1998) model seems relatively comparable to Zimmerman's (1998, 2000), Winne and Hadwin's model is most appropriate for my research in at least five ways. First, contrary to Zimmerman's (1998, 2000) model in which phases are defined temporally, happening before, during, and after the task, Winne and Hadwin (1998) proposed learners may go through the regulatory phases many times throughout one task. While each phase generally forms the basis for what happens next, what happens next may include returning to a previous phase updating conditions and resulting in new products. Thus, rather than modeling sequential steps, the process of SRL is modeled as recursive with weakly sequenced phases. This allows for a more detailed understanding about when and how learners make adaptations to their learning processes.

Second, the COPEs architecture allows for an explanation of how work within each phase is completed and how each phase influences the next (Greene & Azevedo, 2007). Winne and Hadwin do not just suggest learners set goals, but suggest learners cognitively operate on what they know to produce a goal based on their task perceptions and other

conditions such as self-efficacy, and the goal itself is judged against standards. In this sense, they provide a much more detailed account of regulation.

Third, COPES allocates a central role to metacognitive monitoring and control within each phase of regulation thereby fueling the recursive nature of SRL. From this perspective monitoring and control occur throughout learning, not just after task completion, and can be focused on products of regulatory phases as well as task performance.

Fourth, Winne and Hadwin separate task perceptions and goals into separate phases allowing for a more nuanced understanding of learning (Greene & Azevedo, 2007). Both are considered planning for the task, but can be considered separate processes. Learners' goals may be misaligned with the task purpose, meaning learners may be regulating towards a goal that is not aligned with the teacher or coach's expectations (Butler & Winne, 1995).

Finally, although Winne and Hadwin's model has often been described as an information-processing model (cf. Winne, 2001), the inclusion of *conditions* in COPES allows for investigating learning as situated. Situated views of learning (Greeno, 1997, 1998; Lave, 1988) emphasize the social nature of learning and knowledge and argue knowledge is tied to the context in which it was learned. Winne and Hadwin's model suggests conditions are intertwined with learners' choices in regulation at each phase allowing SRL to be historically and culturally situated.

Together, these five aspects of Winne and Hadwin's (1998) model provide a powerful theoretical framework for explaining connections between learning in sports and academics because they outline in detail self-regulatory processes that are necessary to guide productive engagement in tasks. The inclusion of conditions allows for previous experiences with any task to be part of the metacognitive knowledge influencing regulation. The

comprehensive description of SRL at both micro- and macro-levels accounts for adaptations athletes might make mid-skill or routine and students might make in the middle of a physics proof. In addition, because Winne and Hadwin (1998) do not focus specifically on strategy use but rather the basis of learners' decisions regarding strategies, this allows for a consistent theoretical framework across drastically different contexts. The tactics and strategies enacted in Phase 3 in sports (e.g., skating drills) will differ from those enacted in school (e.g., highlighting text). However, as outlined by Winne and Hadwin, both students and athletes need to define tasks, set goals, monitor and evaluate learning, and make changes when progress goes awry. The products of regulatory phases may look different for every task because the conditions are different, but the processes learners engage are similar regardless of whether learning is occurring in academic subjects, sport, music, writing, etc.

### **What is known about SRL and Academic Performance?**

In short, students regulate their engagement in academic tasks and productive regulation is beneficial for performance. While much literature in education has focused on the actual tactics and strategies students enact, theories of SRL including Winne and Hadwin's (1998) model suggest academic learning involves more than creating concept maps and paper outlines. For instance, students differentiate choices in tactics, goals, and resources based on the assigned task (Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001), providing support for *Phase 1* of Winne and Hadwin's model. Task perceptions form the basis for SRL and when students' understanding of implicit and socio-contextual task aspects (Hadwin, 2006) is well aligned with their professors', performance improves (Hadwin, Oshige, M. Miller, Fior, & Tupper, 2008; Oshige, 2009). Additionally, Greene, Hutchison, Costa, and Crompton (2012) reported task definitions evolved from pre- to post-

test suggesting as students progress, they adapt their task definitions. Compared with low test-scorers, high test-scorers reported more goal setting and more process goals as well as more monitoring both during test taking and after receiving grades (Kitsantas, 2002). Performance has been improved when students engage in online monitoring of grades (Geddes, 2009) and of study time, process, and progress (Chang, 2007). Interventions geared towards increasing SRL processes, such as self-monitoring, have resulted in improved performance compared to a control group (Lan, 1996; Schmitz & Perels, 2011).

It is widely accepted that engagement in SRL is mainly positively related to academic success from primary school populations (Dignath, Buettner, & Langfeldt, 2008) to undergraduate students (Kitsantas, 2002). Perry, Phillips, and Dowler (2004) state, “Overwhelmingly, this body of work indicates that SRL is desirable” (p. 1855). Zimmerman’s early work demonstrated higher strategy use for gifted versus non-gifted students (Zimmerman & Martinez-Pons, 1990) and positive links between self-efficacy beliefs and writing course achievement (Zimmerman & Bandura, 1994). More recent work continues to suggest SRL strategies positively influence task outcome (Cleary & Chen, 2009; Hong, Peng, & Rowell, 2009; Malmberg, Järvenoja, & Järvelä, 2010; Schmitz & Perels, 2011). Richardson, Abraham, and Bond (2012) conducted a meta-analysis on variables affecting academic performance including a strategic approach to learning. They defined strategic approach as use of task-specific strategies, which is consistent with models of SRL. A strategic approach to learning was positively correlated with GPA. Further, comparisons of high achievers with low achievers suggest high achievers demonstrate more and more sophisticated engagement of SRL processes (Butler, Cartier, Schnellert, & Gagnon, 2006; Cleary & Chen, 2009; Kitsantas, 2002; Zimmerman & Martinez-Pons, 1986).

### **What is known about SRL and Sport Performance?**

Consistent with students in academic contexts, athletes regulate their learning in sports and this has performance benefits. In interviews, elite athletes underscore the importance of goal setting and self-monitoring for improving performance (Durand-Bush & Salmela, 2002; Orlick & Partington, 1988). Compared with novice athletes, experts engage more sophisticated regulatory processes (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). For instance, novice athletes' goal setting and monitoring focused on outcomes and adaptations revolved around strategies, such as increasing effort or focus. In contrast, expert athletes were more likely to attribute mistakes to faulty technique and, as such, make adaptations focused on technical strategies (Cleary & Zimmerman, 2001). Elite athletes report more self-reflection than lower-level athletes suggesting elite athletes are more attentive to their actions and their strengths and weaknesses (Anshel & Porter, 1996a, Toering et al., 2009). Taken together, this literature suggests elite or expert athletes regulate much more productively than do novice athletes, providing evidence SRL contributes to athletic performance.

The particular self-regulatory process of goal setting has been shown to positively impact sport performance (Bueno, Weinberg, Fernandez-Castro, & Capdevila, 2008; Kane, Baltes, & Moss, 2001). Williams, Donovan, and Dodge (2000) reported initial goals set by track and field athletes influenced performance over and above effects of ability. Athletes also demonstrated adapting goals by (a) lowering goals when there were large negative discrepancies between goals and performance, or (b) setting more difficult goals during the season when previous goals had not yet been met but discrepancies were small (Donovan & Williams, 2003; Williams et al., 2000). The benefits of adapting goals has been

demonstrated experimentally with high school girls assigned to shift from process to product goals performing better than those with assigned goals fixed as either process or product (Kitsantas & Zimmerman, 1998).

Further, adaptive emotion regulation patterns have been linked with performance benefits (Calmeiro & Tenenbaum, 2007) and training in emotion regulation has had a positive impact on competitive performance (Cohen, Tenenbaum, & English, 2006; Prapavessis, Grove, McNair, & Cable, 1992). Training in self-regulatory processes such as self-recording or self-monitoring has been helpful for performance in training sessions (Wanlin, Hyrcaiko, Martin, & Mahon, 1997; Wolko, Hyrcaiko, & Martin, 1993; Young et al., 2009; Zimmerman & Kitsantas, 1996). Cleary et al. (2006) reported self-regulatory training in goal setting, self-recording, and strategic self-reflection resulted in more accurate performance and more engagement in self-correction. Interventions aimed at improving self-regulatory processing also provide evidence SRL matters for sport performance.

### **Transfer Theories and Self-Regulated Learning: Further Theoretical Framework**

Transfer refers to the use or impact of prior learning in a context different than that of initial learning (Marton, 2006; Mayer & Wittrock, 1996). Examining transfer of SRL across different domains requires an understanding of transfer. Though research on SRL across learning domains is limited (Alexander, Dinsmore, Parkinson, & Winters, 2011), there is a rich history in education of examining transfer of knowledge across different tasks (Cox, 1997). In this chapter, I introduce conceptualizations of transfer based on transfer of knowledge literature. I outline current criticisms of transfer theories and research and extend these criticisms to SRL.

As Bransford and Schwartz stated in 1999, “a belief in transfer lies at the heart of our educational system. Most educators want leaning activities to have positive effects that extend beyond the exact conditions of initial learning” (p. 61). Presumably, if learners do not sufficiently learn the material in the first place, transfer is unlikely (Bransford & Schwartz, 1999).

Typical research on transfer involves a two-episode paradigm: learners are trained in a first episode and, after some amount of time, are given a new task to solve that differs in some way from the first but requires similar productions. Researchers then examine if learners applied what was learned in the first episode to the second episode. For example, Walraven, Brand-Gruwel and Boshuizen (2010) reported on two training programs to help students evaluate websites. Training was in the context of history class and transfer was assessed in a task in biology. Students in both training groups demonstrated pre- to posttest improvement; transfer was considered successful in this study. Another example is research on training students to use a business database (Chen, 2010). Training consisted of simple

problem examples and transfer was assessed by performance and process on a complex business problem using the same database. Students who received instruction did no better in using the database in the transfer task than a control group who received no training. Chen concluded transfer failed to occur, as participants with training were unable to use their skills to solve the new business problem. Overall, research on transfer is equivocal and there is continued debate in the literature about the extent to which and conditions under which transfer occurs (Barnett & Ceci, 2002).

Due to the variability in research findings related to transfer, much of the research has focused on delineating conditions that promote or thwart transfer. For example, Barnett and Ceci (2002) created a taxonomy to classify differences between initial learning and transfer contexts in an attempt to explain disparate findings. In terms of *how* learners transfer information, Salomon and Perkins (1989) are among the few to have proposed mechanisms of transfer suggesting two separate methods learners might use in transferring knowledge: (a) low road transfer, in which well-learned knowledge is transferred in an automatic fashion or (b) high road transfer, in which learners intentionally abstract knowledge to apply in a new situation either when the new situation occurs (backward-reaching) or in anticipation of a potential situation (forward-reaching).

### **Challenges and Criticisms of Transfer**

Some theorists (e.g., Tuomi-Grohn, Engestrom, & Young, 2003) have proposed the idea of transfer be abandoned. Hager and Hodkinson (2009) claimed transfer is a poor metaphor for how learners use knowledge. Carraher and Schliemann (2002) argued transfer is a theory of learning that fails to explain how learners are influenced by their prior knowledge and experience. Indeed, many researchers suggest that at a minimum, transfer

should be viewed more broadly than it has been in the past (Perkins & Salomon, 2012). I highlight three critiques of theory and research in transfer relevant to a consideration of SRL.

**Basic nature of knowledge and learning.** Traditional views of transfer have assumed knowledge is something acquired by the individual that is separate from both the learner and the context it was learned in (Hager & Hodkinson, 2009). For transfer to occur, this acquired knowledge is then used in similar ways across contexts (Goldstone & S. Day, 2012; Hager & Hodkinson, 2009). This view arose out of learning theories that held learners passively obtain knowledge (Carraher & Schliemann, 2002). In this traditional theory of transfer whatever is “gained” in the initial learning situation is located within the learner’s memory and then “moved” to (i.e., replicated in) the new situation (Hager & Hodkinson, 2009). However, current research and theory in learning maintain learners are not passive receptacles for knowledge but active participants in processing information and who learn in specific contexts that add essential “texture” to what is learned (e.g., Lave, 1988). From this perspective, learning is historically and contextually situated, and theories of transfer that rely on acquisition views of knowledge do not provide an adequate account of generalization of learning beyond initial learning situations.

**Two-episode paradigm.** As described earlier, the two-episode paradigm generally presents learners with one learning opportunity and one opportunity to demonstrate transfer (Bransford & Schwartz, 1999). Typical measures of transfer are thus one-shot opportunities: learners only have one chance to demonstrate they have learned and can apply the specific concept of interest. Bransford and Schwartz describe this as “sequestered problem solving” because participants are often segregated so they have no opportunities to use resources, seek help, receive feedback, or revise. When learners do not draw on that one particular episode

of learning and demonstrate this in one particular way, it is concluded that transfer has failed; drawing on any other previous learning experience has not counted as evidence of transfer. This is problematic, as learners may not have actually learned the information in the first place (Bransford & Schwartz, 1999) or may draw on other learning experiences (Carraher & Schliemann, 2002). Clearly in everyday life, each new situation does not require learners to begin from scratch yet researchers have been perplexed by the difficulties of demonstrating successful transfer in the lab when using this limited one-shot measure.

**Researcher-defined evidence.** The one-shot measures commonly used in transfer research have also been critiqued because it is the researcher who decides what the concept of interest is and how the learner should demonstrate transfer (Lobato 2006, 2012). When learners do not use the particular knowledge of interest in the manner expected, it is concluded transfer has failed. Schwartz, Chase, and Bransford (2012) argued this view of transfer is limited in its potential to understand how learners draw on previous learning experiences to make the most of their current learning experiences. Lobato (2006, 2012) advocates for an actor-oriented perspective on transfer that focuses on how the learner uses previously learned information, even if incorrect, to grapple with new concepts.

### **How Transfer Does Not Apply to SRL**

Within the literature on transfer of learning, efforts are being made to reconcile theories of transfer with views of learners as active, sense-making agents (Goldstone & S. Day, 2012; Engle, 2012). I do not intend this to be another in a long line of criticisms. My purpose is to examine how these critiques also apply to SRL processes and my analysis suggests current theories of transfer have little to say about SRL across domains. First, I suggest because SRL is a dynamic process and transfer has focused on static concepts, the

concept of interest in these two cases differ on an elementary level. Second, I extend the critiques outlined in the preceding section to the case of SRL.

### **SRL is Not Just Knowledge**

Theories of transfer have focused mainly on transfer of domain knowledge. For example, Fong, Krantz, and Nisbett (1986) investigated undergraduate students' ability to apply the statistical law of large numbers to new academic problems and to statistical problems related to sports. The knowledge of interest, or *what* was being transferred, in the Fong et al. study was the law of large numbers. In Gick and Holyoak's (1980, 1983) seminal work, participants learned a convergence solution in a story about a military general trying to capture a fort and they were expected to transfer the idea of convergence to a new problem about a tumor. In this study, the *what* of transfer was the particular problem solution of convergence and transfer was considered application of this solution to the new problem. The emphasis has been on using a concept or procedure as it was learned but applied to a new problem with different surface features. In other words, deep structure is constant but surface features vary (Chi & Van Lehn, 2012).

Transfer of knowledge literature has focused on *what* was learned, but transfer of SRL is about *how* it was learned. Part of SRL *is* knowledge-based; learners' knowledge about themselves, tasks, and strategies, is critical for SRL (Flavell, 1979). This metacognitive knowledge contributes to learners' choices of goals, tactics, etc. (Dinsmore et al., 2008; Winne & Hadwin, 1998). Metacognitive control refers to the deliberate use of strategies to reach cognitive or metacognitive goals. SRL also includes learners' control over behaviour, emotions, motivation, and some elements in the environment. SRL is about having metacognitive knowledge, continually refining it, and using that knowledge to adapt

processes for and knowledge used in learning in the face of challenge. Thus, metacognitive knowledge is one aspect of regulation, but regulation is much more than knowledge about self, tasks, and strategies. While transfer of knowledge literature has focused on static knowledge applied as is, transfer of SRL would involve transfer of a dynamic, adaptive process.

One area within the transfer literature relevant to this discussion is transfer appropriate processing (TAP). Morris, Bransford, and Franks (1977) proposed TAP as a theory to account for transfer by focusing on *how* memory was acquired and retrieved rather than *what* material had been memorized. Morris et al. demonstrated information retrieval from memory was not always best if processing during acquisition was deep rather than shallow. But when acquisition processing was appropriate to the type of retrieval test, performance benefited; that is, transfer was most successful when processing requirements were matched in the “learning” episode and the “transfer” episode (e.g., Mulligan & Lozito, 2006; Park & Rugg, 2008). For example, on a reading task participants performed better on types of questions they were cued to think about before reading than on other types of questions and than other groups who did not receive the same cues (McCrudden, 2011). TAP puts an emphasis on the processing occurring during learning and transfer rather than on the static concepts being learned, just as SRL is focused on processes learners engage to learn. However, TAP attempts to account for successful and unsuccessful transfer by examining cognitive processing whereas the focus of the present paper is the transfer of regulatory processes per se.

At the most basic level, theories of transfer do not apply to SRL because SRL is not knowledge. SRL is a dynamic process, continually adapted to different contexts. Theories

and research on transfer have tended to focus on object-level data, related to the content material itself (Nelson, 1996). Investigation of SRL transfer across domains is an examination of transfer at the meta-level and thus is likely to require modifications and extensions of current theories of transfer.

### **Extending the Critiques**

First, traditional views of transfer have been critiqued for treating knowledge as something that is disconnected from the context and the learner (Hager & Hodkinson, 2009). This critique is extended to SRL because SRL is considered context specific. Theoretically, learners engage SRL processes for all learning tasks, but these processes are modified depending on the conditions of the particular situation (Winne, 1995a). SRL is a process that changes and evolves as the learning environment changes and evolves. Situated views of learning (Greeno, 1997, 1998; Lave, 1988) emphasize the social nature of learning and knowledge and argue that knowledge is tied closely to the context in which it was learned. This sensitivity to context, including social aspects, that surrounds learning is critical to SRL (Hadwin et al., 2001; Hadwin et al., 2011), yet this is not captured by traditional views of transfer focusing on acquired pieces of knowledge that are considered separate from the learning context.

Second, typical transfer research has been criticized for requiring learners to draw on one particular experience when demonstrating transfer. This critique is extended to SRL again because SRL is context specific. That is, learners develop goals and choose strategies by considering multiple aspects of the environment and their own internal beliefs and knowledge. It seems unlikely when choosing and modifying strategies based on these multiple aspects learners would draw only on one particular experience or one particular

metacognitive “fact.” Every human has a rich history of learning experiences, all situated in different contexts, on which to draw. Thus learners may consider a variety of regulatory experiences rather than focusing on one specific experience as is required in typical transfer research.

Third, research on transfer has been critiqued for focusing on demonstrations of transfer as expected by the researcher rather than taking an actor-oriented perspective that allows learners to demonstrate transfer in a variety of ways that are defined after the fact (Lobato, 2006, 2012). This is extended to SRL because SRL involves covert processes, thus any evidence of transfer would benefit from taking an actor-oriented perspective. Many regulatory processes are not traceable or observable and are dependent on learners’ perceptions of their learning and the conditions surrounding learning; as Winne, Zhou, and Egan (2011) emphasize, SRL is a *self*-phenomenon. Learners choose tactics based on perhaps incomplete and biased samples of when that tactic was helpful or not, and decide when progress is not quick enough based on their judgments of knowing. Thus researching SRL requires that the learners’ own perceptions are taken into account to understand how learners make decisions. When SRL is seen as a self-phenomenon in which the learner’s perspective is critical for understanding regulation, researcher-defined evidence of transfer is unlikely to fully capture how learners make use of previous regulatory events. Considering (a) learners might draw on a multitude of experiences and (b) learners decisions in SRL are often covert, it is difficult to define a priori what regulatory processes learners are transferring between domains and how they are doing so.

### **Does SRL transfer across learning contexts?**

Zimmerman (1998) observed that expert writers, athletes, musicians, and students may be learning in different domains, but they share similar strategies in terms of goal setting, imagery, time management, etc. Zimmerman concluded self-regulatory “techniques are used on diverse tasks – ranging from mundane daily work or practice tasks to acclaimed performances in the arts, sports, and writing.” (p.76). While evidence suggests learners engage regulatory processes in both sport and academics and SRL is positively related to performance in these domains, this certainly does not qualify as evidence that there is any kind of relation between SRL across domains for a single learner.

A small body of existing research focused on metacognition in different academic domains suggests SRL does generalize across domains. First, students trained in metacognition demonstrate improvement in achievement and strategy use. For example, Adey and Shayer (1993) tested an intervention including metacognitive aspects integrated into science lessons and found achievement in standardized tests for science, mathematics, and English language was improved two or three years after the intervention program for those who had taken part. The authors concluded metacognitive skills transferred to other course work. Masui and De Corte (1999) reported on an intervention contextualized within an economics class to teach students orienting to tasks and self-judging their orienting activities, both metacognitive activities. Relative to control students, intervention students were able to give more sophisticated reports of orienting and self-judging related to a subsequent statistics class.

Second, investigations of the relation between SRL in different domains suggest learners use metacognition in similar ways. J. Miller (2000) reported a significant positive

correlation between self-reported SRL scores focused on strategy use in mathematics and in English. Veenman and colleagues (Veenman, Elshout, & Meijer, 1997; Veenman & Spaans, 2005; Veenman, Wilhelm, & Boshuizen, 2004) examined learners' approach to academic tasks in two or more different domains and concluded metacognitive skills are domain-general. For example, Veenman and Spaans (2005) reported on high school students' metacognitive skillfulness measured by observations, think aloud verbalizations, and log files. Metacognitive skill was defined as evidence of planning, monitoring, and reflecting. They found high correlations between metacognition scores for math and biology tasks for the 3<sup>rd</sup> year high school participants. Veenman and Spaans interpreted these results as evidence for metacognition as a domain-general skill.

These two lines of research provide support for the notion that regulatory processes are related across different academic domains. Yet, this research is scarce and, as Alexander and colleagues (2011) noted, we still know little about transfer of SRL processes across different domains. The research to date is limited by (a) focusing solely on metacognition relating to cognitive processes, ignoring how learners monitor and control behaviour, motivation, or affect; and (b) examining transfer only across academic subjects and domains rather than more broadly across learning contexts. Transfer within and across learning contexts, such as from academics to sport or music, has received little attention despite the importance of SRL in these domains (e.g., Zimmerman, 1998). To understand whether regulation is applied across these unique domains requires systematic inquiry into whether the same learners use and apply regulatory processes in both domains. This in turn requires appropriate measures of SRL.

### **Approaches and Challenges to Measuring SRL: Methodological Considerations**

The dynamic, adaptive nature of SRL provides several challenges for researchers, and measurement of SRL has been diverse, including various self-report instruments, think aloud protocols, trace data, and microanalytic techniques (Cleary, 2011; Winne, 2010; Winne & Perry, 2000; Winne et al., 2011). Using Winne and Hadwin's (1998) model as a framework, I highlight three aspects critical to the definition of SRL: (a) SRL has properties of an aptitude and an event; (b) SRL is a complex and multi-faceted phenomenon; and (c) SRL involves not only what learners do but also learners' perceptions of their cognitions and actions. Much has been written about measurement of SRL because it is only when we understand how this process occurs and where it breaks down that we can develop supports for sophisticated regulation and transfer across domains.

#### **Aptitude and Event**

Winne and Perry (2000) described SRL as having a dualistic character: SRL can be viewed as an aptitude and as an event. An aptitude is defined as a person's readiness or potential to benefit within a situation and is considered a relatively enduring characteristic (Snow, 1992). An aptitude is a predictor of behaviour. Across different contexts and across time, a learner with an aptitude for SRL is more likely to take advantage of situations in which regulatory processes may be beneficial. Measures that espouse the aptitude properties of SRL aggregate learners' actions across both time and context. For instance, the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1993) asks learners to judge how true 81 statements are of them with respect to learning in a particular course which likely involves many different tasks and spans at least a term of studies.

Alternatively, the event property of SRL can be emphasized (Winne & Perry, 2000). An event is delineated in time with a beginning and an end. Grain size is a reference to the scope of information considered in measurement of SRL. The most appropriate grain-size of an event for understanding how regulation unfolds is still in debate within the SRL literature (McCardle, Hadwin, & Winne, 2012; Winne et al., 2011). Winne and Perry (2000) outlined three successively more complex levels of events. First is an occurrence, where an observable feature indicating SRL comes into existence. For example, a learner exclaims something is difficult; this implies a metacognitive judgment against a standard, going from absence to presence of this indicator of SRL. Second is a contingency, a conditional relation between two occurrences, usually modeled as an IF-THEN relation (Winne, 1997, 2010; Winne & Hadwin, 1998; Winne, Jamieson-Noel, & Muis, 2002; Winne & Perry, 2000). If a learner exclaims something is difficult and then asks for help, this implies a contingency between these two actions: actions of metacognitive monitoring (IF the task is difficult) and metacognitive control (THEN I ask for help). Third, a patterned contingency is a collection of IF-THEN contingencies considered a cognitive strategy: actions (THENS) create products for evaluation, which allows the learner to create new conditions (IFs) for deciding on the course of further actions (more THENS). Whether this pattern occurs within a single episode of studying or training or across episodes is unclear. Malmberg and colleagues (2010) operationalized patterned contingencies as a series of tactics that were regularly used by learners in the same order over several sessions.

Importantly, Winne and Perry (2000) do not argue views of SRL as an aptitude and event are opposing. Rather, SRL has properties of both. Winne and Perry go so far as to say “the event prior to the current one is like a brief-lived aptitude that may predict the next

event” (p. 534). However, considering an aptitude is defined as a “relatively enduring attribute” (p. 534), I consider an aptitude to be of a much larger grain size than an occurrence, contingency, or patterned contingency, as it encompasses judgment across many events.

Assessing SRL can mean assessing at any grain size from occurrence to aptitude. Examining SRL as an aptitude or as an event has implications for (a) the time focus and (b) the context focus of the research. In terms of time, as grain size increases, the amount of time encompassed in a measure of SRL also increases. Assessing an occurrence means examining a relatively short period of time, as does assessing a contingency. These events consist of only one or two actions. Examining patterned contingencies means assessing a larger span of time to see what patterns of tactic use emerge and can be considered strategic. McCardle et al. (2012) suggested using a one- to two-hour episode as a time frame for studying SRL; this would mean assessing occurrences, contingencies, and patterned contingencies within and potentially across multiple one- to two-hour episodes. Aptitude measures of SRL reflect responses across a relatively long period of time. This can be within a course, a semester, or in an undefined period of learning.

By definition, SRL is context specific: internal and external conditions impact the standards and operations a learner chooses (Winne & Hadwin, 1998), making each set of standards and operations specific, but not necessarily unique, to that particular context. For instance, Hadwin et al. (2001) demonstrated the tactics learners engage vary by the assigned learning tasks such as reading a text or writing a paper. Thus, when assessing SRL at a small grain size, the context can be specific: one or a collection of actions prior to the one in question provides context for interpreting the present action. For example, if a learner’s

actions are making a judgment that something is difficult and then seeking help, the first action provides information about the conditions that prompted the second, i.e., a judgment of inadequate learning. Measuring SRL as an event means observing learners' actions as they occur at a specific time in specific conditions.

Larger-grained aptitude measures of SRL aggregate information across various contexts and conditions; e.g., if assessing SRL in one course, it could refer to an amalgam of taking exams, writing papers, giving presentations, etc., as well as all the more specific aspects of contexts, such as judgments of learning. As such, aptitude measures fail to capture learners' adaptation of actions to the conditions surrounding learning. As the grain size for measurement in SRL increases, the time frame under question increases and the contexts considered broaden. When SRL is measured as an aptitude, the actions being assessed occur over a large amount of time and in different contexts. This is assessing learners' readiness to use regulatory processes by assessing their tendency to use such processes over time and over a wide-range of tasks.

Whether assessing occurrences or patterned contingencies, it is important to assess the conditions of the larger context as well as learners' actions. Winne et al. (2011) posited that facets of contexts to consider are (a) the task being undertaken; (b) any related, supporting tasks; (c) the extent to which the learner has access to information, including domain content and knowledge about SRL; (d) the opportunities to reduce cognitive load; and (e) the demand on working memory in relation to available resources.

### **Collection of Interrelated Processes**

SRL is a multifaceted phenomenon; Winne and colleagues (2011) characterize SRL as “a complex, multidimensional, temporally extended orchestration of successively

conditionally dependent events” (p.103). According to Winne and Hadwin’s (1998) model, it involves four phases. In each phase, learners engage five processes (COPES). Learners regulate their cognition, their behaviour, their affect, and their environment. Learners engage tactics and strategies. Winne et al. outline five features of contexts and five individual learner variables to consider. In addition, they describe eight features of SRL: (a) cues, or features of the task/environment; (b) goals, attribute to judge progress; (c) tactics, operations learners use; (d) forecasts, learners’ expectations about tactics; (e) accounts, learners’ beliefs about relation between tactic and product/forecast; (f) utility, learners’ cost-benefit analysis relative to a tactic; (g) likelihood, probability learners will engage a tactic; and (h) logs, learners’ records of SRL.

These different aspects of SRL cannot be treated separately from one another (Winne et al., 2011). Theories of SRL posit aspects and phases of SRL influence one another (Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). Examining learners’ goals, for instance, without examining any other feature of SRL, the context, or individual learner variables, provides an incomplete assessment of SRL. According to Winne and Perry (2000), even measuring an occurrence as a minimal level of grain size requires knowledge about *two* states. Understanding SRL requires examining how the cues perceived by learners relate to the goals they set, how tactics and strategies are chosen based on the goal, how learners perceive features of operations they carried out to create products, and so on. In aiming to understand SRL researchers study how contexts and individuals interact via the processes learners engage to learn. Winne (1997, 2010; Winne & Hadwin, 1998; Winne et al., 2002; Winne & Perry, 2000) describes tactics not simply as an action, but a condition and an action (IF-THEN), emphasizing the importance of this relation. However, he (Winne et al., 2011)

concedes the “real-world is probably more complex than represented by a theoretical IF-THEN structure” (p.110).

Is it ever possible to capture all the nuances of learners’ SRL? Likely not. It is unlikely that any single measure of or measuring process SRL can capture the complexities of SRL: the eight features highlighted by Winne et al. (2011) in COPES across all four phases of SRL. Triangulation of data across methods is recommended when assessing a phenomenon as complex as SRL (Winne et al., 2011). While assessing all aspects might be ideal, it is difficult to do so and to make sense of such data. Thus, in measuring SRL it is critical to be explicit about which particular features of SRL are of interest.

### **Perceptions in a Self-Phenomenon**

Winne has argued (Winne, 2010; Winne & Perry, 2000; Winne et al., 2011) self-reports of SRL are limited and possibly unreliable reflections of the construct because self-reports depend on human memory. Learners base responses on (a) inaccurate recall of SRL products and processes, (b) an incomplete and biased sample of experiences, (c) experiences across a variety of contexts, and (d) strategies they know or believe to be effective rather than ones they actually engage (Winne et al., 2011). These problems maybe exacerbated by aptitude measures of SRL that ask learners to aggregate across many learning episodes and tasks. Research suggests learners’ perceptions of what they do are not well calibrated with their actual behaviour (Winne et al., 2002). For example, students self-reported engaging twelve specific study tactics such as reviewing objectives and making notes in their own words more frequently than they did so according to trace data (Winne & Jamieson-Noel, 2002). Thus, several researchers advocate for using objective measures of SRL such as trace

data to capture the context and choices learners make as they study (Azevedo, Moos, Johnson, & Chaucey, 2010; Winne et al., 2011).

Indeed, attempts to measure SRL have shifted towards more objective measures. In academic contexts, this has meant a focus on computer-generated traces of SRL (e.g., Hadwin, Boutara, Knoetzke, & Thompson, 2004; Hadwin & Winne, 2001; Malmberg et al., 2010; Nesbit et al., 2006; Winne & Hadwin, 2011; Winne & Jamieson-Noel, 2002). Computer software has the advantage of affording learners the opportunity to engage with content material while creating performance-based, time-stamped logs of all the learners' actions. Software programs such as nStudy (Winne, Hadwin, & Beaudoin, 2010) track learners' use of options such as highlighting text and creating tags, notes, and glossaries (Winne & Hadwin, 2012). While challenges remain in interpreting logfile data (Hadwin & Winne, 2001; Winne, 2010, 2011), these objective measures of what learners do reduce problems inherent in self-report measures. In sport contexts, there have been attempts to develop observational checklists of SRL (Toering, Elferink-Gemser, Jordet, Jorna, Pepping, & Visscher, 2011; Young & Starkes, 2006a, 2006b). Both research teams of Toering et al. (2011) and Young and Starkes (2006a, 2006b) used interviews with coaches to develop a list of behaviours that were considered indicative of self-regulation or non-regulation, respectively.

While the use of trace data in academics and observation in sports provide much needed objective measures of SRL, “what matters in our account is that SRL is a *self* phenomenon” (Winne et al., 2011, p. 92). The reality of SRL is that it (a) involves covert processes which are not traceable or observable, and (b) is dependent on learners' perceptions. In terms of covert processes, several unobservable cognitive events are essential

to SRL. For instance, in Phase 1 of Winne and Hadwin's (1998) model, learners create internal representations of an externally assigned task (whether that be writing an essay or completing a pass in football). This is a covert process that has no overt parallel. Thus in order to examine how learners interpret tasks, it is necessary to ask them. In terms of learners' perceptions, it is likely that when learners respond to questionnaire items about whether they set goals, for example, they draw on an incomplete and biased sample of experiences with setting goals across a variety of contexts. What learners remember and what actually occurred are not always synonymous (Winne & Jamieson-Noel, 2002; Winne et al., 2002). But learners base the goals they set on their own perceptions of previous goal setting, choose tactics based on incomplete and biased samples of when that tactic was helpful or not, and decide when progress is not quick enough based on their inaccurate judgments of knowing. Though learners' memories may be faulty, it is these faulty memories on which they base their choices in engaging with a task (Nelson, 1996). Hence it is necessary to gather data that represent how learners' perceive their own regulatory processes. Learners' accounts of their interpretations contribute to richer measurement of SRL. When learners' reports of regulation are triangulated with data related to what learners actually do it provides insights into how learners judge the context and their own actions.

### **Methodological Considerations**

In sum, when choosing measurements of SRL, it is important to consider that SRL (a) has a dual characteristic as an aptitude and an event; (b) involves multiple, interrelated processes; and (c) is manifested in both covert and overt actions. These ideas lead to four key questions that need to be answered in order to choose among different ways of researching SRL: (a) What is the *time* frame being considered? (b) What is the *context* being

considered? (c) What *features* of SRL are being considered? And (d) *whose* perceptions of SRL are being considered? In this dissertation I used four different types of measures across three empirical papers. Each measure is described below and how each method addressed the four key questions is summarized in Table 1.

## **Questionnaires**

Two questionnaires were used in this dissertation research. Questionnaires are easy to administer and summarizing data across large groups of participants. In this dissertation, I shifted from using an aptitude-based questionnaire in McCardle, Jonker, Elferink-Gemser, and Visscher (2014) to an event-based questionnaire in McCardle and Hadwin (2015). The first questionnaire was the Self-Regulated Learning – Self-Report Scale (SRL-SRS; Toering, Elferink-Gemser, Jonker, van Heuvelen, & Visscher, 2012). It has six subscales related to regulatory processes and motivation: planning, self-monitoring, evaluating, reflecting, self-efficacy, and effort. Most items are rated on Likert scales based on frequency of engagement anchored by *never* and *always*. The SRL-SRS is an aptitude measure of SRL as it asks learners to aggregate responses across time and tasks. The SRL-SRS demonstrates internal consistency, test-retest reliability (Toering et al., 2012), and supports valid interpretations about constructs as evidenced by significant correlations between SRL-SRS scores and observations of SRL behaviour (Toering et al., 2011). Toering and colleagues (2012) originally designed the SRL-SRS as a domain-general measure of SRL. However, considering most theories of SRL propose context influences SRL, the measure was adapted by McCardle and colleagues (2014) to be domain-specific for sport training and for academic learning. This allowed us to examine similarities and differences in how student-athletes perceived their own regulation in these two contexts.

The second questionnaire was the Regulation of Learning Questionnaire (RLQ; McCardle & Hadwin, 2015). Developed by Hadwin (2009), the RLQ is based on Winne and Hadwin's (1998) model of regulation with five subscales: task understanding, goal setting, monitoring, evaluating, and adapting. Items are rated on Likert scales from *not at all true of me* to *very true of me*. Participants were instructed to respond based on one particular study session for an exam. This means the RLQ is an event-based measure: the task was held constant and the time frame was limited to one study session. This allowed us to assess learners' perceptions of their regulation in relation to that one particular study episode.

### **Diary Measures**

Two diary measures were used in this dissertation research. Diary measures were considered an event-based measure of SRL as they centered on particular goals within the time-course of an episode. This data provided information about the goals participants used as standards, judgments they made about attaining those standards, and challenges specific to that particular event. First, students taking a course about SRL each week for 11 weeks completed Weekly Reflections (McCardle & Hadwin, 2015). The cycle began with a *planning* section in the first lab where the focus was to set a goal for one study session in the following week. In week 2, students started with the *reflecting* section and considered their goal attainment and challenges in meeting their goal set the previous week, followed by completing another *planning* section for the following week, and so on. Second, the student-athlete participant in McCardle's (2014) case study completed similarly structured Study and Training Journals. After completing either a study session or a training session, the student-athlete reported his goal for the session and reflected on attainment, challenges, and adaptations made and planned. Both Weekly Reflections and Study and Training Journals

included close-ended items rated on scales (e.g., did you reach your goal today) and open-ended items (e.g., describe what you struggled with in trying to attain your goal). This allowed for rich descriptive responses beyond what can be disclosed in close-ended questionnaire items such as found in the SRL-SRS and RLQ.

### **Interviews**

A semi-structured interview was used in McCardle (2014) to collect rich data on SRL across both sport and academic contexts. Using Winne and Hadwin's (1998) model as a guide, questions covered (a) demographics, (b) descriptions of typical training and study sessions, (c) phases of regulation and evaluating progress, (d) examples of one recent challenge and approach to overcome this in each sport and academics, and (e) opinion on the connection between sport and academic learning. This allowed for rich descriptions of how the participant approached training and studying, of learners' general beliefs about learning, and the types of challenges learners face. Analysis of the interview was both inductive and deductive, guided by Winne and Hadwin's model.

### **Video-Stimulated Recall**

The final type of measure used in this dissertation was a video-stimulated recall for both a study session and a training session (McCardle, 2014). In video-stimulated recall, participants are shown a video of their learning session and asked to use the video as a reminder of the cognitive events that took place during the behavioural actions captured on film (Lyle, 2003). The video-stimulated recall occurred immediately after an observation session, and the participant was asked to focus specifically on challenges faced in the session. Winne (1995b) makes the case that SRL involves both deliberate and non-deliberate engagement of cognitive processes; learners are most likely to deliberately engage in SRL

when they face difficulties (Hadwin et al., 2011). Thus, challenge episodes were chosen for the focus of the VSRs because it was assumed that learners would deliberately engage in self-regulatory processes in response to challenges and be able to speak to and recall these processes. Video-stimulated recall is an event-based measure of SRL, as it focused on a specific time frame and in this case, particular challenges (McCardle, 2014). This allows for rich data related to SRL events as they unfold and is particularly helpful when think aloud protocols are impossible, such as during sport performance.

Table 1 *Methodological Aspects Addressed in Three Empirical Dissertation Papers*

	McCardle et al., 2014	McCardle & Hadwin, 2015			McCardle, 2014 <sup>a</sup>	
Summary of measures	SRL-SRS	RLQ	Weekly Reflections	Interview	Study & Training Journals	Video-stimulated recall
Time frame	None	One study episode	Working on one goal (suggested 2hr time frame)	None, though participant was asked to reflect on one recent challenge in each sport and academics	One study or training session	One study or training session
Information about context	Information about sport, years in sport, level of education. Nothing specific to how learners answered items.	Given context of one study episode for a recent exam. Context information requested was course.	The task and goal the learner reported.	History in sport, program information for school. Whatever specific information participant provided about context.	The goal the learner reported.	Observation video.
Features of SRL <sup>b</sup>	Planning, self-monitoring, evaluating, reflecting processes and self-efficacy and effort	Task understanding, goal setting, monitoring, evaluating, adapting	Explicitly: goal setting, evaluating, adapting. Implicitly: task understanding, metacognitive knowledge, motivation.	Task understanding, goal setting, monitoring & evaluating, adapting, challenges, metacognitive knowledge, big picture. Learners'	Task understanding, goal setting, monitoring & evaluating, adapting, challenges, metacognitive knowledge, big picture. Learners'	Task understanding, goal setting, monitoring & evaluating, adapting, challenges, metacognitive knowledge, big picture. Learners'
Perspective	Learners'	Learners'	Learners'	Learners'	Learners'	Learners'

*Note.* Items for each measure can be found in the appendices of the respective papers.

a. I also planned to use an observation method in McCardle (2014). One training session and one independent study session were recorded for the participant. These videos were intended to serve as an objective measure of SRL by coding for evidence of SRL. Use of these videos was limited to the basis for video-stimulated recall because (a) sport training involved other individuals, complicating analysis and ethics, (b) my limited experience with table tennis made it difficult to code for behavioural nuances that might indicate regulation, and (c) discussion between the participant and his training partner, which may have been an interesting window into SRL, was in Dutch.

b. Features of SRL were defined a priori for SRL-SRS and the RLQ, but were a combination of data-driven and theory-driven coding for Weekly Reflections, Interview, Study and Training Journals and Video-Stimulated Recall Interview.

### **SRL from the Field to Study Hall: Research Purpose and Overview of Papers**

Some studies show that student-athletes have demonstrated concurrent success in sport and academic domains and one potential explanation is that SRL is applied across these two domains. Research examining student-athlete regulation has been limited by (a) a focus on domain-general SRL, and (b) comparing athletes with non-athletes. **The purpose of this dissertation research was to empirically explore student-athletes' SRL in and across their academic and sport learning.** This dissertation research unfolds over three separate, published (or under review) papers (see Table 2 for a summary). Collectively, these papers address two aims that comprise the purpose of the dissertation research. While research has compared athletes and non-athletes in terms of regulation (Jonker et al., 2010) and examined students' metacognition in different academic subjects (Veenman & Spaans, 2005), no research has examined student-athletes' regulation in both sport and academics. To understand whether SRL may be a link between these two domains, the first aim was to explore the relation between SRL in sport and academic learning domains for the same learners. Suitable measures of SRL are critical to understanding how learners' adapt regulatory processes for different domains and debate continues within SRL literature about ways to research SRL. The second aim of this dissertation research was to explore methods of measuring SRL. A brief overview of each manuscript and its specific contribution to the global aims of the dissertation follows.

**Paper 1: McCardle, L., Jonker, L., Elferink-Gemser, M. T., & Visscher, C. C. (2014).**

*Self-regulated learning in sport and academic domains for competitive youth athletes.*

**Manuscript in submission.**

McCardle, Jonker, Elferink-Gemser, and Vissher (2014) examined the relation between student-athletes' SRL in sport and academics. Participants were 215 competitive youth athletes who completed a self-report measure of SRL called the Self-Regulated Learning – Self-Report Scale (SRL-SRS; Toering et al., 2012). On the SRL-SRS, learners reported the extent to which they engage four regulatory processes (planning, self-monitoring, evaluating, and reflecting) as well as two motivational variables (self-efficacy and effort). Participants completed the SRL-SRS twice, answering items once for their sport training and once for their academic learning. Strong factorial invariance models were accepted for each subscale indicating changes in scores reflect changes in latent variables rather than changes in the measurement. Latent mean correlations revealed high positive correlations across all subscales, with the exception of effort that showed a moderate positive correlation. Findings suggest student-athletes who engage SRL in one domain also do so in the other. Latent mean differences demonstrated participants reported more engagement of SRL and higher motivation for their sport training than their academic learning. Findings have implications for the role of motivation in SRL and the role of contexts in supporting regulatory development. This paper contributes to the dissertation research by (a) establishing a positive relation between SRL in the two learning domains of interest, and (b) revealing limitations of disposition-based, self-report measures of SRL.

**Paper 2: McCardle, L. & Hadwin, A. F. (2015). Using multiple, contextualized data sources to measure learners' perceptions of their self-regulated learning. *Metacognition and Learning*.**

McCardle and Hadwin (2015) explored measurement issues related to self-reports of SRL. Recognizing learners' perceptions of their learning are critical for understanding

Table 2 *Summary of Dissertation Papers*

Purpose	Empirically explore student-athletes' SRL in their sport and academic learning		
Reference	McCardle et al., 2014	McCardle & Hadwin, 2015	McCardle, 2014
Research Questions	Is there a relationship between student-athlete regulation in sport and academics?	What measurement issues arise with self-report of SRL and how can we address this?	Does a student-athlete employ similar regulatory patterns in sports and academics?
Specific Research Questions	<ul style="list-style-type: none"> <li>•Are self-reported scores of SRL process and motivation in sport and academics related?</li> <li>•Are there differences in self-reported engagement of SRL and motivation in sport and academics?</li> </ul>	<ul style="list-style-type: none"> <li>•What is the factor structure of the RLQ?</li> <li>•What quantitative patterns of regulatory engagement emerge across one semester?</li> <li>•What patterns emerge when quantitative and qualitative data are combined?</li> </ul>	<ul style="list-style-type: none"> <li>•What characterizes this student-athlete's regulation in sport and academic contexts?</li> <li>•What similarities and differences exist in how this student-athlete regulates in sport and academic learning?</li> </ul>
Method, Measures & Analyses	<ul style="list-style-type: none"> <li>•Correlational</li> <li>•SRL-Self-Report Scale</li> <li>•Factorial invariance, latent mean correlations &amp; differences</li> </ul>	<ul style="list-style-type: none"> <li>•Correlational</li> <li>•Regulation of Learning Questionnaire &amp; Weekly Reflection Diaries</li> <li>•Exploratory factor analysis, latent class analysis, qualitative profiles</li> </ul>	<ul style="list-style-type: none"> <li>•Case study</li> <li>•Interviews, study &amp; training journals, observation, video-stimulated recall</li> <li>•Qualitative coding</li> </ul>
Aims Addressed	<ol style="list-style-type: none"> <li>1. Relation between SRL in two domains</li> <li>2. SRL methods</li> </ol>	<ol style="list-style-type: none"> <li>2. SRL methods</li> </ol>	<ol style="list-style-type: none"> <li>1. Relation between SRL in two domains</li> <li>2. SRL methods</li> </ol>

regulation, we investigated the use of two types of self-report measures that were situated in a specific learning episode: (a) the Regulation of Learning Questionnaire (RLQ; Hadwin, 2009), a self-report, Likert scale measure based on Winne and Hadwin's (1998) model of SRL; and (b) Weekly Reflection diaries with open-ended and rated items related to planning for and reflecting on one particular goal. University students ( $N = 263$ ) were taking a course designed to teach about and guide application of SRL processes. This meant we expected shifts in how participants regulated. Participants completed the RLQ at the beginning and end of the semester and completed Weekly Reflections each week of the course for 11 weeks. We conducted three analyses. First, exploratory factor analysis of the RLQ resulted in five subscales: task understanding, goal setting, monitoring, evaluating, and adapting subscales. Second, latent class analysis revealed four profiles based on RLQ scores, capturing changes from the beginning to the end of the semester: *emergent regulators*, *moderate regulators*, *high regulators with emergent adapting*, and *high regulators*. Third, we compared qualitative profiles of a subsample based on Weekly Reflection entries to the quantitative profiles based on RLQ that emerged from the latent class analysis. Despite both data sources being self-report, the profiles had varying levels of overlaps. These results point to the importance of capturing self-report data, along with other measures, particularly as regulation is developing. This paper contributes to the dissertation by (a) explicitly examining the potential of self-report assessments of SRL to capture changes over time, and (b) addressing some of the measurement limitations identified in McCardle et al. (2014). This paper tackles the measurement issue head on, uncovering some inconsistencies in how learners report their own regulation and revealing the importance of triangulating across

multiple types of self-reports to understand the perceptions upon which learners base their regulatory.

**Paper 3: McCardle, L. (2014). *Similarities and differences in self-regulated learning processes in sport and academics: A case study*. Manuscript in submission.**

McCardle (2014) used an in depth qualitative case study approach to explore engagement of regulatory processes in sport and academic settings for one student-athlete. Case study provided an ideal methodology to allow for in-depth, in-context inquiry into learning in sport and academic contexts using multiple data sources. The participant was a male, international level table tennis player also enrolled in sport sciences program at a university in the Netherlands. Data were (a) a semi-structured interview, (b) video-stimulated recall interviews in sport and academics, and (c) journal entries centered on daily goals in sport and academics. Qualitative coding was data-driven and theory-driven, guided by Winne and Hadwin's (1998) phase model of SRL. Winne and Hadwin's model was designed originally to explain independent academic studying and this was the first study to extend this model to sport contexts. The participant evidenced engagement of all four phases of regulation and of metacognitive monitoring and evaluation in his sport training. These processes paralleled his regulatory engagement in his academic studying, pointing to the similarities in metacognition and regulation across both domains. Differences between domains were (a) a more proactive and detailed approach to his sport training than to his academics; and (b) the active, guiding role of the coach in comparison to his professors. This paper again builds on McCardle et al. (2014) by conducting an in-depth exploration of SRL across sport and academics as well as on McCardle and Hadwin (2015) by adapting Weekly Reflections for use in sport. This paper contributes to the dissertation research by (a)

illuminating similarities and differences in how one student-athlete engaged SRL processes thereby demonstrating transfer of regulation is possible and (b) using multiple measures and qualitative coding to create a profile of SRL contributing to understanding measurement of SRL.

### **Ethics**

Separate ethics were approved for each empirical paper. Research for McCardle et al. (2014) was conducted as part of a Dutch-funded project at the University of Groningen. All procedures were in accordance with ethical standards of the institution, which conform to the World Medical Association Helsinki Declaration. The school governing bodies, parents, and youth athlete participants gave their consent.

Research for McCardle and Hadwin (2015) was conducted as part of a larger project on student regulation at the University of Victoria. Participants were informed of project aims and requirements, and the ability to withdraw participation at any point in the study and participants gave informed consent (Appendix A). Research was conducted in a university course and information on consent was withheld from course instructors until after final grades were submitted.

Research ethics for McCardle (2014) were approved at the University of Victoria and data were collected in Groningen, the Netherlands. Participants were informed of project aims and requirements and gave informed consent (Appendix B). Participants were also informed of the ability to withdraw participation at any point and were reminded at each meeting with the researcher.

### **Conclusion: Findings on SRL across sport and academic domains**

The overarching aim of this dissertation research was to empirically explore student-athletes' SRL in and across their academic and sports learning. This purpose was achieved through a collection of three separate manuscripts. Two specific aims were addressed: (a) to explore the relation between SRL in sport and academic domains, and (b) to explore methods of measuring SRL. For each aim, I summarize the main findings from the dissertation, discuss theoretical implications and address limitations. Then, I examine future directions for this line of research, including a proposition for using Winne and Hadwin's (1998) model as a framework for researching SRL across domains. Finally, I describe the relevance and implications of examining SRL across different learning contexts.

#### **Aim 1: Relation Between SRL in Sports and Academics**

Research has suggested elite athletes are able to succeed both academically and athletically (e.g., Brettschneider, 1999; Watt & Moore, 2001). SRL is a logical link for partially explaining concurrent success in these domains because SRL has been related to success in sport (e.g., Cleary & Zimmerman, 2001) and academics (e.g., Kitsantas, 2002). This idea has been gaining ground in the literature (e.g., Jonker et al., 2009; Jonker et al., 2010). Two papers specifically addressed this aim, with two findings of note.

#### **Finding 1: Positive Relation Between SRL in Sports and Academics**

First, findings from McCardle et al. (2014) demonstrate a positive relation between SRL in sports and academics. McCardle et al. had learners respond to each item of the SRL-SRS once for academic learning and once for sport training. This builds on work by Jonker et al. (2010) by encouraging participants to differentiate between how they approach learning in sport and in school. Planning, self-monitoring, evaluating, reflecting, and self-

efficacy subscales exhibited high, positive correlations and effort demonstrated a moderate, positive correlation. Student-athletes who reported high engagement of regulatory and motivational processes in one context also did so in the other, while student-athletes who reported lower engagement also tended to do so in both domains.

McCardle (2014) also addressed this aim using a case study of an international table tennis player and university student. Evidence for engagement of Winne and Hadwin's (1998) phases of regulation was found in both in this individual's sport training and academic studying. That is, the participant described scanning features of and making sense of tasks, setting goals, monitoring and evaluating learning, and making adaptations when necessary in both learning contexts. Further, the participant described metacognitive awareness of how he learned best in each domain with an understanding of his strengths and weaknesses. Taken together, these findings suggest there is a positive relation between SRL in sport and academics. This  $N = 1$  instance opens the door to hypothesizing that students who regulate in sport also regulate in academic contexts.

A limitation of these studies was that samples were limited to elite level athletes. Building on research indicating expert athletes successfully engage SRL (e.g., Cleary & Zimmerman, 2001), participants were strategically sampled based on their successful performance in sport. As such, it was expected participants report high levels of SRL in sport, allowing for examination of differences in how student-athletes engaged regulatory processes in sport and school (McCardle, 2014). However, future research is needed to examine whether there is a proportional relation between SRL in sport and academics across levels of sport participation or whether the relation holds only for elite level athletes.

Further, correlation does not equal causation and a third variable may be influencing the relation between SRL in sport and academics; that is, there maybe something else about high-level athletes that allows them to engage in productive self-regulation in both domains. For example, intelligence may be one factor considered as a third variable impacting metacognitive skill and therefore performance. Research by Veenman and colleagues (Veenman et al., 1997, 2004; Veenman & Spaans, 2005) investigated the relation between intelligence and metacognitive skill, concluding these two constructs develop in parallel but do not fully depend on one another. Another possibility may lie in a base level of regulatory skill that sets these learners apart and contributes to succeeding in *any* domain. While some theorists have hypothesized about the development of regulatory skills (Schunk & Zimmerman, 1997), little empirical research has addressed this question longitudinally. Research suggests SRL can improve with training even for primary school students (Dignath et al., 2008), but we know little about how SRL develops. One possibility is that athletes have had exposure to good models of SRL. Research suggests coping models can boost individuals' level of self-efficacy and performance in a skill (Schunk, A. Hanson, & Cox, 1987; Zimmerman & Kitsantas, 2002) and modeling has been suggested as an important step in the development of SRL (Schunk & Zimmerman, 1997). Further research is needed to explore development of SRL within and across learning domains to elucidate the cause of the relation between SRL in sport and academic domains.

### **Finding 2: Differences Between Sport and Academic Contexts**

Second, evidence suggests while there is a positive relation between learners' reports of SRL in sport and academic contexts, there may be some differences in these two contexts as well. Competitive youth athletes reported significantly higher levels of engagement of all

regulatory and motivational processes assessed by the SRL-SRS in sport than in academics (McCardle et al., 2014). The student-athlete participant in McCardle (2014) evidenced two particular differences in his SRL in sport and academics: (a) in sport he consistently referred to a bigger picture or vision, including personal strengths and weaknesses, that guided his goals and his training; and (b) in sport he described his coach as playing a critical role throughout the training and competition process. Neither of these characteristics was present in his description of his academic learning. Indeed, Jonker et al. (2009) specifically proposed SRL skills would be developed in sport and transferred to academic learning suggesting sport as an ideal context for developing SRL. At least two possibilities exist to explain differences in SRL engagement: (a) differences between sport and academics suggested by this dissertation research are limited to elite level athletes and lower level or recreational athletes may not demonstrate such differences (or similarities) between SRL in sport and academics; and (b) characteristics inherent to each context support and constrain SRL in different ways. If the former is true, this points to motivation as a key variable likely to be a source of different approaches to learning in sport and academics. If the latter is true, this points to immediate feedback and coaching as characteristics of sport contexts that support SRL in ways academic contexts are unlikely to do so. These possibilities are not mutually exclusive. I address each in turn.

**Motivation.** If differences in SRL engagement are due to a factor that differentiates elite level athletes and lower-level athletes, motivation may play a key role as elite athletes tend to have very high levels of motivation for training in their sport (Baker & Young, 2014). Motivation is considered critical for SRL (e.g., Boekaerts, 1995; Pintrich, 2000; Winne & Hadwin, 2008): SRL is an effortful process and it takes motivation to engage in

something effortful (Zimmerman, 2011). Higher levels of effort and self-efficacy reported in sport over academics by student-athletes in McCardle et al. (2014) suggest these participants were especially motivated to pursue their sport. One aspect of sport likely to result in increased motivation relative to motivation for school is choice; athletes choose their sport and the level at which they compete. Choice is considered one indicator of motivation and that elite athletes choose to practice their sport and commit countless hours to training suggests a high level of motivation. On the other hand, school may be seen as something students have to do, especially for high school students, and reported motivation levels for general student populations are low (e.g., Falco, Summers, & Bauman, 2010; Harackiewicz, Rosek, Hulleman, & Hyde, 2012; McCann & Turner, 2004; Wolters & Rosenthal, 2000). Thus, motivation for succeeding and therefore regulating in academics may pose greater challenges.

Related research on expertise suggests athletes who achieve expert status are highly motivated (Ericsson et al., 1993). Ericsson and colleagues (1993) suggested a minimum of approximately ten years or 10,000 hours of deliberate practice to achieve levels of expertise. Deliberate practice is highly effortful practice that is purposefully structured to identify and overcome weaknesses; in this regard, deliberate practice has some parallels to SRL (Nandagopal & Ericsson, 2012; Young & Starkes, 2006a). Deliberate practice has also been described as not inherently enjoyable and researchers suggest engagement in this type of structured, focused practice requires high levels of motivation. This definition of deliberate practice was developed based on retrospective reports from musicians, who reported sustaining and maximizing motivation through years of development (Ericsson et al., 1993). However, athletes report enjoying deliberate practice that requires intense mental effort and

that is most relevant to their development as athletes (Hodges & Starkes, 1996). While some have struggled to explain this in relation to the deliberate practice definition (e.g., Ericsson, 1996), this simply adds to the notion that elite level athletes are able to maintain high levels of motivation for their sport training.

A regulatory process often linked to motivation is setting goals. In models of SRL, goals are standards against which learners judge their progress, potentially prompting adaptations (Winne & Hadwin, 1998). However, goals are also considered motivational or energizing as they provide learners with direction (Hidi & Harackiewicz, 2000). Elite athletes are assumed to be pursuing the goal of being the best in their sport. This provides athletes with motivation and standards, thus encouraging SRL. In school, all students may not be pursuing top grades. For elite athletes, much of their time is committed to sport (Watt & Moore, 2001), thus their academic goals may be set at a lower level simply due to lack of time. The participant in McCardle's (2014) study demonstrated this by saying he intended to split his time and effort between sport and academics half and half but if something suffered, it was always his academics. Thus if goals are considered motivational, lower level goals for academics rather than sport would mean less motivation. This is likely to be particularly true for elite athletes relative to recreational athletes.

It is important to note that it is possible to productively regulate toward "lower" goals, such as the goal of passing a course. Researchers in the field link objective success with higher engagement of regulation implying more SRL means better performance; but learners may be regulating effectively to their own standards, without performing at high levels objectively. This highlights the importance of capturing data on students' goals when defining "success" (Boekaerts, 1995).

Research is warranted to address whether similarities and differences demonstrated to date between SRL in sports and academics are limited to elite athletes. This would require examining student-athletes at a variety of levels of sport proficiencies (e.g., elite, competitive, and recreational), taking care to assess levels of motivation as well as SRL for both sport and academics. While research has suggested elite athletes and successful students engage more sophisticated and sustained SRL than their less successful counterparts (e.g., Kitsantas & Zimmerman, 2002), research is needed to examine how level of competitiveness in sport impacts relation of regulation in sport to academics.

**Immediate feedback.** If differences in SRL across sport and academic domains are due to characteristics of the learning contexts, immediate feedback is one area in which these two contexts may differ. While there is variation across tasks and situations in both academic and sport domains in terms of the timing of feedback, students often spend considerable time working on academic tasks without any external feedback (Butler & Winne, 1995). For instance, students can work on entire sections of math homework with no indication if they have the correct answer, write and re-write entire essays without feedback, conduct and report science experiments using the wrong materials, or study for history exams without any external indication of what they know and do not know. That is, unless a teacher, peer, or computer tutoring system provides feedback, students can spend a lot of time learning the wrong things or not learning at all.

Sport tasks are much more likely to provide immediate feedback about performance. Soccer players know immediately if their passes made it to their teammates, hockey players know if the puck went in the net, gymnasts know if they landed the vault, and swimmers can check their time to see how fast they swam. Most sport tasks have some kind of immediate,

objective feedback. This feedback is usually related to the outcome rather than process, which Butler and Winne (1995) suggested provides minimal guidance for how to self-regulate. However, when feedback is immediate and regular, knowledge of results may provide an important contextual cue for considering the learning process. For instance, if a gymnast consistently falls off the balance beam, this is a cue to consider what she may be doing wrong in the skill that results in her falling off. Whether immediate or delayed, external feedback is an external condition learners may consider when choosing standards and operations for defining tasks, setting goals, and choosing strategies (Butler & Winne, 1995; Winne & Hadwin, 1998) and thus is important to consider in examining development and transfer of SRL.

**Role of coach.** If differences in SRL across sport and academic domains arise due to varying characteristics of the learning contexts, the role of the coach or teacher is another area in which these two contexts may differ. The coach-athlete and teacher-student relationships will vary depending on a number of variables, particularly across team and individual sports. Regardless, I speculate athletes tend to work much more closely with a coach than do students with their teachers, and this close relationship may be likely to influence development of SRL. Indeed, elite athletes describe working closely with their coaches (Durand-Bush & Salmela, 2002; Orlick & Partington, 1988). The table tennis player in McCardle (2014) described his coach as being important for creating accurate task perceptions, for setting appropriate goals, for monitoring performance, and for deciding on approaches to training. Coaches often work individually with athletes or in small groups and athletes often train with the same coaches for years. In comparison, teachers often work with groups of 20-30 students, limiting the individual attention each student receives. Also,

students often have new teachers each year and for different subjects within a year. At the university level, professors can have minimal individual contact with a student and students often are left to their own devices in terms of studying textbook material, and preparing papers. Thus while athletes “worked out programs, problems, and strategies *together* with their coach” (Orlick & Partington, 1988, p.120, italics in original), teachers and professors may have relatively more distant relationships with students. Further, coaches and athletes’ goals at the elite level are likely well aligned, both holding a vision for winning or performance. In academics, teachers’ goals for their students cover a broader spectrum and thus teachers and students may be less likely to have goals that are aligned. What this means is that coaches are better positioned to act as a co-regulator, guiding athletes’ own SRL (Hadwin et al., 2011). That is, a coach can ask questions and cue athletes to relevant conditions for understanding tasks, setting goals, and choosing strategies as well as provide feedback on process and performance, prompting athletes to make adaptations. The danger with working so closely with a coach is they may become an “other” regulator (Hadwin et al., 2011), doing the regulation for the athletes rather than acting as a guide or support for the athletes’ self-regulation. In this case, this type of relationship may hamper athletes’ development of SRL.

More research is needed to examine contextual differences between sport and academics that may influence both the development and transfer of regulation. I suggest roles of feedback and coaches as places to begin. Comparison of different types of sport such as team sports vs. individual sports with careful attention to contextual features will illuminate differences in the influence of context on development and transfer of SRL. In Jonker and colleagues’ (2010) study, individual athletes reported higher planning and effort

scores than team athletes on the domain-general SRL-SRS. Whether this applies to sport, academics, or both is unclear and future research is needed to further examine this possibility. Further research is also needed to address whether athlete-coach relationships are more likely to entail co-regulation or other regulation, whether athlete-coach goals are more aligned than student-teacher goals and how these variables impact learners' SRL and performances.

### **Aim 2: Explore Methods of Measuring SRL**

Measurement of SRL is complicated because SRL can be considered both an event and an aptitude. SRL involves multiple, interrelated processes and depends on learners' potentially biased and inaccurate perceptions. Debate continues in the literature about best approaches to measuring SRL with a recent emphasis on measuring SRL as an event (Azevedo et al., 2013; Winne, 2014). This emphasis on SRL as an event is useful in unpacking regulation of learning as it occurs and in testing models of SRL. Thus, the second aim of this dissertation was to explore methods of measuring SRL. I used four self-report measures of SRL across three empirical studies: (a) questionnaires, (b) diary measures, (c) interviews, and (d) video-stimulated recall. Each type of measure brought strengths and weaknesses. I discuss my approach in relation to four key questions: (a) What is the *time* frame being considered? (b) What is the *context* being considered? (c) What *features* of SRL are being considered? And (d) *whose* perceptions of SRL are being considered?

#### **Time Frame**

As SRL can be considered to have properties of both an aptitude and an event (Winne & Perry, 2000), specifying the time frame during which data about SRL is gathered is important for understanding whether measures are aptitude or event based. Larger grain-

size measurements that cover larger spans of time are usually considered aptitude measures as learners sample multiple events from experience to answer items. The SRL-SRS used in McCardle et al. (2014) and the interview used in McCardle (2014) were aptitude-based measures as they lacked a specific time frame. That is, learners could draw on recent or old events to answer questions. Smaller grain-size measures used were diary measures (Weekly Reflections in McCardle & Hadwin, 2015, and Training and Study Journals in McCardle, 2014), video-stimulated recall used in McCardle (2014) and the RLQ used in McCardle and Hadwin (2015). By specifying a particular learning episode, we were able to focus one study session or one training session, and consider events that unfolded within that session. However, with the exception of the video-stimulated recall, the remaining event-based measures used in this dissertation are limited by a reliance on the participant to draw only on one particular event when answering items. Of note, the participant in McCardle (2014) struggled to keep his descriptions to a recent event when asked about it in the interview and when reflecting on specific challenges in the VSR. Thus, while researching how learning unfolds and how learners make regulatory decisions requires event-by-event analysis, learners may not make sense of their own learning in such a detailed manner.

As focus shifts to understanding SRL as an event, capturing relatively enduring changes in SRL over time becomes difficult. For example, it may be of interest to capture a change from a student minimally considering task criteria to consistently, deliberately considering task criteria. This change may be due to regulatory experiences in other domains or interventions designed to improve SRL, such as the SRL course described in McCardle and Hadwin (2015). Measuring this type of change is challenging when SRL is expected to be adapted for each unique situation. This requires multiple data points across a long span of

time. SRL profiles based on multiple events might be created for different blocks of time and then these profiles can be compared from one block of time to another.

The RLQ was used across a semester in an attempt to capture this type of change (McCardle & Hadwin, 2015). This type of questionnaire presents new challenges as learners are expected to answer differently to each administration of the questionnaire because SRL processes are expected to be different depending on task and context. Conventional notions of reliability and validity have been developed for measures of constructs that are expected to remain stable over time, with factorial invariance across time expected. Factorial invariance models were less than ideal in McCardle and Hadwin (2015), suggesting participants' responses had some variability across time. As we highlighted, it is possible that differences in stability of responses to multiple RLQ assessments may distinguish between effective and ineffective regulators. Research is needed to ascertain the extent to which changes in response to RLQ items reflect changes in context or more stable changes in learners' regulatory approach. That is, how are event and aptitude properties of SRL related? Though emphasis has shifted to understanding SRL as an event, the importance of events in creating an aptitude to engage regulation has not been emphasized. Looking for changes across time and across domains suggests more research and theory are needed to examine how event and aptitude properties of SRL are related and how these properties relate to transfer of SRL across domains.

### **Context**

Context is critical to understanding regulation because standards and operations are specific to the particular conditions of the situation (Winne & Hadwin, 1998). This means collecting data about the task, resources, and other possible supports and constraints in the

environment (Winne et al., 2011). As Winne and Perry (2000) note, each regulatory event becomes a condition for the next event. Similar to time frames, contexts for measurement in this dissertation ranged from large-grained, broad contexts to smaller-grained, more specific contexts. Again the SRL-SRS used in McCardle et al. (2014) and the interview used in McCardle (2014) were large-grained, with data collected about context limited to the learning domain, i.e., sport or academics. Participants were asked to aggregate responses across different tasks. Yet even considering SRL across sport and academic contexts at such a large grain-size, the differences between reported engagement in these two contexts (McCardle, 2014; McCardle et al., 2014) support the notion that contexts influence SRL. In smaller-grained measurements, such as the RLQ, limiting the time frame a participant considered allowed us to focus item responses on one task, in this case exam studying. However, limited data were collected about available resources or supports in the environment. More detailed data on context were gathered in diaries in McCardle (2014) and McCardle and Hadwin (2015), which centered on goals. In this case, participants' goals provided context for interpreting participants' strategies, their monitoring, and their adaptations. Video-stimulated recall requiring observation videos in McCardle's (2014) case study provided the most specific details about context.

As Winne has argued (Winne & Perry, 2000; Winne et al., 2010; Winne, 2014), understanding how learning unfolds and how learners make regulatory decisions requires collecting event-by-event data. The smaller grain-size measures used to collect data in this dissertation provided measures closer to this ideal. Being more specific in terms of short time frames and particular contexts will allow for a better understanding how regulatory processes fit together.

## **Features**

Several features of SRL are considered important to capture learning as it unfolds (Winne et al., 2011). Data from multiple types of measures in this dissertation were analyzed at the macro-level of SRL phases (Winne & Hadwin, 1998) either by nature of the items (e.g., RLQ; McCardle & Hadwin, 2015) or the theory-driven analysis (e.g., interviews, diaries; McCardle, 2014; McCardle & Hadwin, 2015). This focus on macro-level phases is consistent with most research to date (Greene et al., 2012). To both understand regulation and test models such as Winne and Hadwin's, researchers need to focus on capturing the micro-level processes described by COPES. This is particularly important to begin to understand how learners transfer regulatory processes across domains (McCardle, 2015).

Findings from McCardle et al. (2014) and McCardle (2014) highlighted the importance of motivation in regulation. Winne et al. (2011) also noted motivation as critical by including what they called local task drive in the individual variables to consider in researching SRL. Winne and colleagues describe local task drive as the degree to which learners want to succeed at the particular task. This draws attention to omission of motivation in measures used such as the RLQ and diaries used in McCardle & Hadwin (2015) and McCardle (2014). Future research needs to examine incorporation of task-specific motivation into measures of SRL.

## **Perceptions**

Self-reports have been criticized as they rely on flawed human memory (Winne et al., 2011) and research in SRL has seen a shift towards more objective measures such as logfiles and observations. However, regulatory decisions depend on how learners' make sense of their learning (Nelson, 1996). To capture learners' perceptions of their learning, the

measures used in this dissertation were self-report measures (McCardle, 2014; McCardle et al., 2014; McCardle & Hadwin, 2015). Results of McCardle and Hadwin (2015) highlight learners' self-reports can differ and do not always tell the same story. Thus, while it is important to capture learners' perspectives of their decisions and actions, triangulating these measures with data related to what learners actually do it will provide valuable insights into how learners judge the context and their own actions. Understanding learning as it unfolds will require collecting multiple types of data from both learners' perspective and more objective measures.

One limitation in some of the measures used was the time delay from when the learning episode took place to when the learners complete measures. For example, in the SRL course (McCardle & Hadwin, 2015) students may have set a goal on a Monday, worked on the goal on Thursday, and then reflected on that work the next Monday. In McCardle (2014), the participant was instructed to fill out a Journal immediately after either the training or study session but the exact time delay is unknown. This time delay means learners may answer differently than they would have during the event potentially responding with a more reflective reply (Lyle, 2003), and this is less than ideal when aiming to capture SRL as it unfolds. Promising measures that eliminate time delays include think aloud protocols, computer logfiles, and microanalysis (Cleary, 2011). Each brings its own strengths and weaknesses and combining multiple types of data will help to provide a clearer picture of how learners manage challenges and adapt their approach to learning (Azevedo et al., 2013).

### **Future Directions**

This dissertation took a first step in exploring SRL across domains by establishing a relation between how individuals regulate in these two domains. Taken further, exploring transfer of SRL means understanding how previous experiences influence regulatory decisions in new situations (McCardle, 2015). This dissertation also explored methods of measuring SRL. Measurement of SRL is critical for being able to measure and understand how learners adapt regulatory processes for new experiences. Two clear gaps remain in the literature: (a) research is needed to establish whether SRL in one domain can influence a second learning domain; and (b) further steps are needed to understand *how* past experiences influence learners' present regulatory processes.

#### **Capturing Transfer of SRL Across Domains**

That there is a positive relation between SRL in sport and academics and that student-athletes report more engagement of SRL in sport suggests additional research is needed to tease apart whether the relation between SRL in sport and academics is causal or whether there is another variable that promotes student-athletes' success and engagement of SRL in these two domains. Transfer itself is a complex process fraught with methodological challenges (Bransford & Schwartz, 1999); combining this with measurement considerations for SRL presents several challenges. Two important aspects are important to consider when looking at transfer of SRL. First, Lobato's (2006, 2012) emphasis on an actor-oriented perspective suggests gathering learners' perspectives is critical in understanding transfer. This is especially important when exploring transfer of a collection of cognitive and metacognitive processes such as SRL in which learners' reasoning about regulatory

decisions is key. Thus measures of SRL that take learners' perspectives into account are likely to be useful in capturing SRL across domains.

Second, it is important to gather data on the context details and learners' regulatory products (i.e., task perceptions, goals, strategies). Because SRL involves adapting strategies to different tasks and contexts, regulatory products are likely to change from one task to another and from one domain to another (McCardle, 2015). This does not imply learners are not transferring SRL processes, but rather that they are doing so appropriately. It does mean that transfer is difficult to assess since regulatory processes and products will not necessarily "look" the same from domain to domain. Lobato's (2012) actor-oriented approach suggests what transfer "looks" like is difficult to define a priori since one cannot be sure what previous experiences and knowledge learners will draw on. In the past, not drawing on one particular learning episode has been interpreted as failure of transfer, but more recent views of transfer acknowledge the ways learners draw on previous experiences might not always be as expected. In Lobato's work, for instance, she explored students' understanding of slope and how different conceptualizations of slope resulted in different evidence of transfer than might have been expected if students had the "correct" understanding (e.g., Lobato, Rodehamel, & Hohensee, 2012). In this case, slope is a new concept for these students and they have limited experiences with this idea. In terms of SRL, learners have a lifetime history of facing and adapting to challenges and when faced with a new situation, may draw on any or multiple of those experiences. Thus, capturing learners' perspectives and the details of contexts and regulatory products are important for capturing transfer of SRL.

While there are likely a multitude of methods to begin exploring the influence of SRL experiences across domains, I propose two different approaches. The first would

explore inter-individual differences in approaching novel learning situations. Groups of learners could be purposefully sampled as “high” and “low” regulators in a particular domain or domains. Note “high” and “low” regulators should not be equated to “successful” and “unsuccessful” performers, as it is theoretically possible to regulate effectively to lower performance goals. Participants would be exposed to a challenge in a novel domain. For instance, they may be taught a new game to which none had had exposure, such as rugby players learning to play chess. The hypothesis would be if learners are able to transfer regulatory skills, learners who are “high” regulators in the original domain should be able to apply regulatory processes to the new challenge better than learners who were considered “low” regulators. No differences in how learners regulate in the new challenge would suggest learners do not transfer their regulatory skills. Veenman and colleagues (1997) have used a similar process with tasks in physics, statistics, and a fictitious knowledge domain, finding positive relations between metacognition in different knowledge domains.

A second possibility would use in-depth analysis of learners’ SRL in response to a challenge. Video-stimulated recall or think aloud protocols could be used to explore learners’ reasoning in making regulatory decisions for evidence of drawing on previous experiences, and in particular, previous experiences in different domains. Participants might even be prompted at the end as to whether they considered previous regulatory experiences in another domain. Challenge episodes provide an interesting catalyst for this type of approach since learners are especially likely to deliberately engage SRL processes when faced with challenges (Hadwin et al., 2011). Because it is unclear prior to which experiences learners might draw on and how they might use that, evidence for “transfer” would need to be identified in learners’ verbalizations after the fact.

## **Mechanisms of Transfer**

A second gap remains in understanding *how* past experiences influence learners' present regulatory processes. I propose Winne and Hadwin's model has potential to shed light on transfer of regulatory processes. The promise of their model lies in that they outline SRL at two levels: the macro level of phases distinguished by the unique products created throughout work on a task and the micro level of processes that explain how cognitive work is completed within and across phases (Greene & Azevedo, 2007). The COPES model of SRL suggests conditions play an important role in regulation and I suggest it is here that previous regulatory experiences influence learning across tasks and domains.

According to Winne and Hadwin (1998), *conditions* guide regulation by affording learners' choices in standards and operations. In their model, conditions include internal and external factors. External conditions are the environmental factors that surround learning, such as resources, instructions, time available, and social context. For instance, learners' standards and operations may change depending on whether there is a help menu in the website or not, whether the instructions were step-by-step or vague, whether learners are rushed to meet a deadline, or whether the group they are working in has a leader. Social contexts may influence learners' SRL via the external conditions.

Internal conditions are the cognitive factors pertinent to the task, including learners' beliefs and dispositions, motivational factors, knowledge of the domain, of the task, and of tactics and strategies. For instance, the operations and standards learners choose may depend on whether they believe intelligence is incremental or stable, whether they have high or low self-efficacy, whether they have written an essay exam before, and whether they have metacognitive knowledge of tactics appropriate for the task.

As conditions change, cognitive and metacognitive tactics engaged by learners change. I propose it is in the conditions that similarities between tasks are perceived and then impact the rest of the regulatory cycle. As Winne (1997) outlines, the tactics learners engage can be thought of as an IF-THEN statement, where IFs can be considered conditions. For instance, in completing math homework, an IF-THEN might look like IF it is a math question THEN find the formula and complete. For a gymnast learning a back handspring on the balance beam, an IF-THEN might look like IF it is a back handspring, THEN set up properly and be sure to see the balance beam. In this case, there seems to be little possibility for transfer for a student-athlete. But, an IF-THEN in math might be IF the question seems difficult, THEN ask my teacher for help. The student-athlete might transfer this tactic when faced with a similar condition in gymnastics: IF the back handspring seems difficult, THEN ask my coach for help. The help-seeking tactic is one that is likely to be easily transferred – modified and applied – to new situations.

Within the COPES typology (Winne & Hadwin, 1998), internal conditions (IFs) are recursively updated by three sources, two of which I propose at least partially account for how previous experiences influence regulation in present tasks. That is, learners transfer SRL processes from task to task, within and across domains by modifying THENS for particular IFs that have been updated by previous experiences (see Figure 1).

First, products of other regulatory phases become conditions for future phases. For instance, task perceptions created in Phase 1 are part of the internal conditions for setting goals, and goals created in Phase 2 are part of the internal conditions for choosing tactics in Phase 3. This source of update seems most likely to influence regulation within work on a particular task and thus is unlikely to play a critical role in transfer of SRL.

Second, external evaluations are sources of judgment about learners' performance made by someone or something (e.g., software) other than the learner. These might include whether an answer to the math question matches the correct answer, whether a student did not meet a deadline, whether an athlete ran a faster time, or whether a coach gave an approving nod. These become conditions for further engagement with the task or new tasks. For instance, IF I failed the exam THEN study harder next time, IF I handed my work in late THEN make a plan to be on time, IF my times were slow THEN focus on the leg drive, or IF my coach is happy with my performance THEN remember how that performance felt.

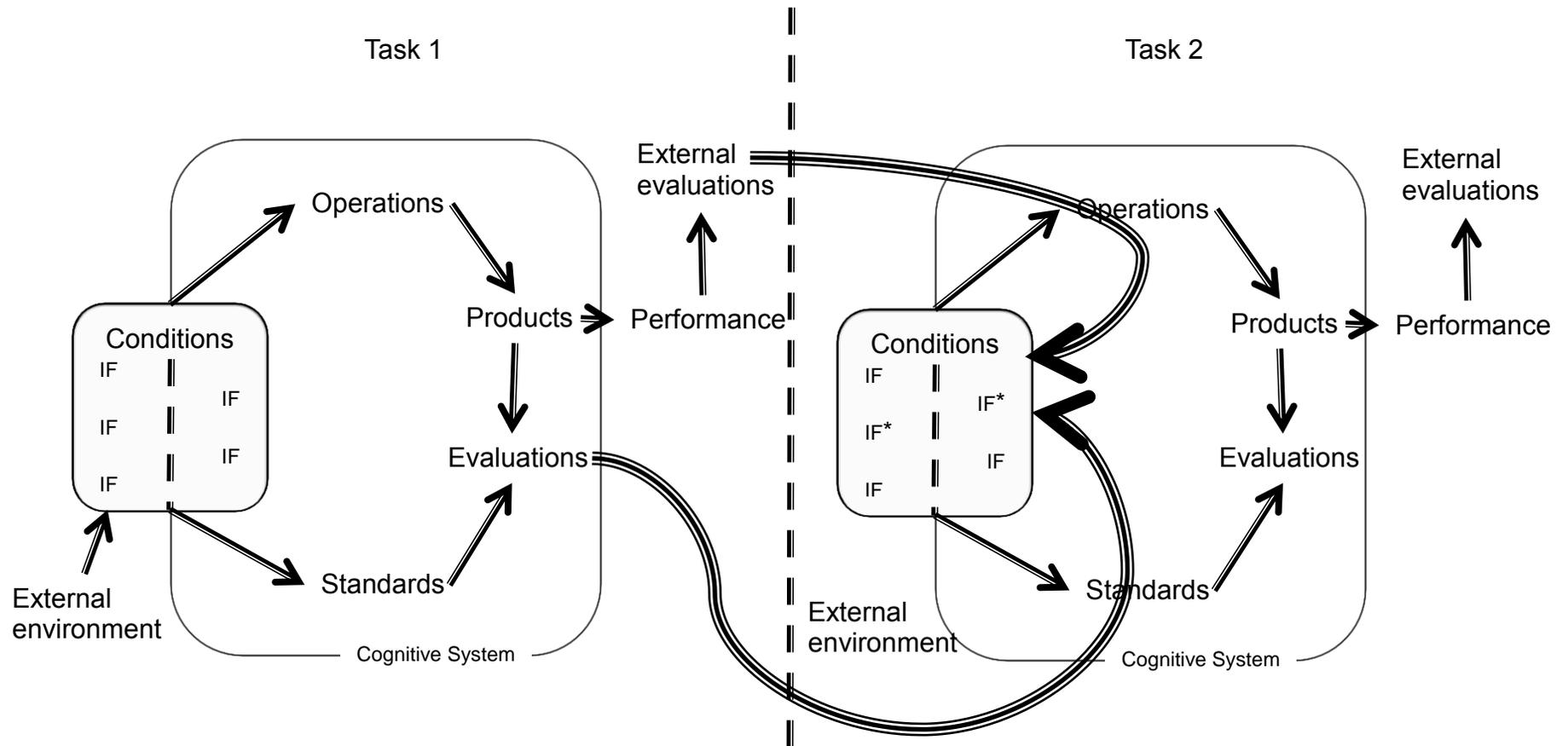
Third, metacognitive evaluations are learners' comparison of cognitive and metacognitive products to personal standards. While learners make metacognitive judgments about the products of their learning, such as whether they understand the math procedures well enough or feel comfortable with the back handspring on the balance beam, learners also make judgments about the processes they use to learn. For instance, learners might consider whether asking for help was an effective strategy, whether setting a specific goal was helpful, or whether they really understood the task. These judgments can become part of learners' metacognitive knowledge about tasks and tactics that can play a role in subsequent learning experiences. For instance, IF asking for help was an effective strategy THEN go to office hours to speak to my professor, IF setting a specific goal was helpful THEN choose a specific time to run, IF I missed the purpose of the task THEN be sure to read instructions carefully.

In addition to the three recursive updates to internal conditions (external evaluations, regulatory products, and metacognitive evaluations), conditions are updated as task conditions change. External conditions include resources, instructions, time available, and

social context. Thus, if a more knowledgeable peer is no longer present during studying, this changes both the social context and resources available to learners. Across tasks, this is similar to traditional views of learning as learners detect similarities between the task conditions (e.g., surface structure; Chi & Van Lehn, 2012). In SRL, similarities do not have to be only in the content of the task, but rather any kind of environmental feature. For instance, IF time is limited, IF I am working alone, IF I forgot my textbook, or IF someone is using the lane I like to run in.

Thus, it is possible learners find connections across learning episodes in task conditions, external evaluations, and/or metacognitive evaluations. Yet it seems unlikely learners see similarities from one context to another and apply tactics as they were used in the original situation, such as IF the task seems difficult, THEN ask my teacher/coach for help. The conditions surrounding learning are multiple – e.g., beliefs, knowledge of the task, resources, etc. Each situation will be a unique combination of conditions and actions a learner takes to engage with a task will be adapted from context to context. As the number of salient conditions increases, there will be more complexity in the IFs. More complex, and more realistic, IF-THEN structures look more like IF it is a math question and IF it is hard and IF I am studying with a friend and IF my self-efficacy is low THEN ask my friend for the formula. Or for the gymnast, IF it is a back handspring on the beam and IF it is hard and IF my coach is present and IF my self-efficacy is low THEN ask my coach to provide assistance. In any learning situation there are a potentially infinite number of conditions the learner might attend to. In choosing tactics and strategies, learners are likely to sample what they consider to be salient conditions to guide these choices.

Figure 1. Depiction of transfer of SRL processes with three connections between Task 1 and Task 2: External evaluations, metacognitive evaluations, and external environment.



Note. IF\* denotes similar conditions from Task 1 to Task 2.

In terms of transfer, while there may be similarities from one situation to another for one or two element of the conditions (i.e., IFs), each situation is a unique combination of IFs making transfer of regulation complex. Tactics may shift and be modified to suit the particular combination of conditions. For example, when learners have previous successful experience with IF the back handspring seems hard THEN ask for help from my coach, this might have to be modified to apply to a situation in school with IF the math question seems hard and IF I am studying alone, THEN search the internet for an instructional video.

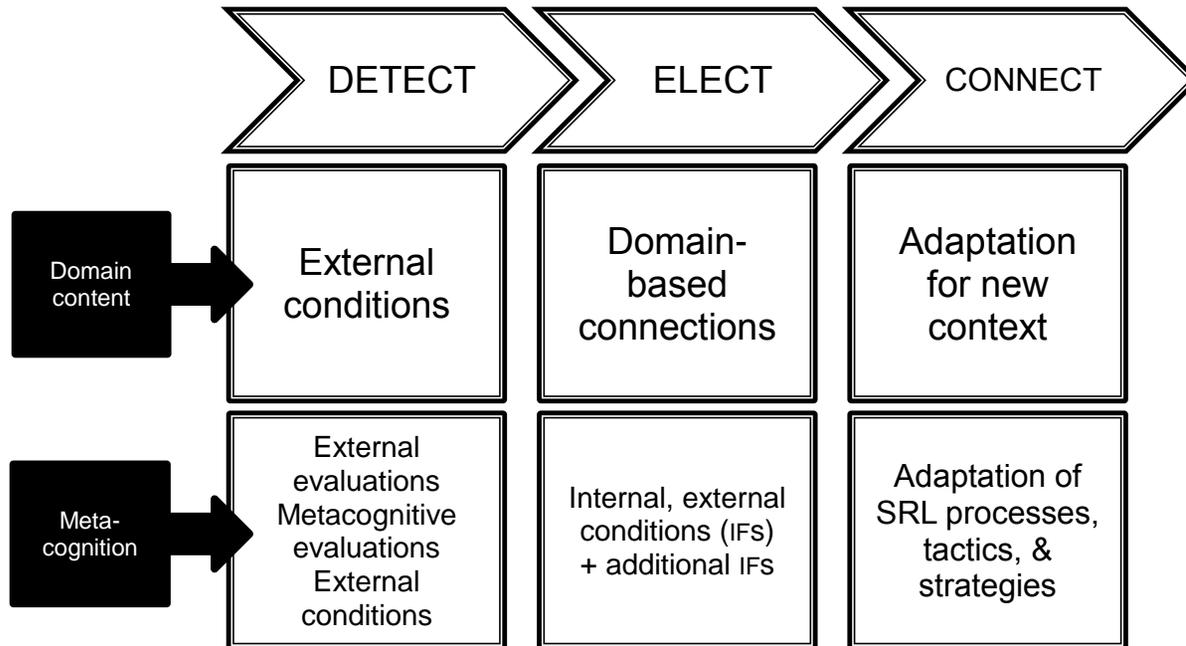
Another route may be that learners are looking to engage a specific SRL process, such as aiming to improve task understanding, or trying to figure out how to monitor. For example, an action may focus on the regulatory process itself, such as IF the math question seems hard, THEN find a way to make sure I understand the question. In academics, this might mean reviewing instructions, messaging a peer to clarify the meaning of the question, reviewing the last unit of instruction. In particularly aiming to develop accurate task perceptions in gymnastics, a student-athlete may review videos of experts completing back handsprings online, practice the skill on the floor rather than the balance beam, or practice mental imagery of the skill. This would mean what learners transfer from one experience to another is the abstract purpose of the tactic, that is the process they want to engage and they modify and adapt tactics as needed based on conditions. It is unclear whether learners make abstractions about metacognitive tactics in this way or not and more research is needed to understand this. Marton (2006) highlights the importance of differences in being able to make abstractions, thus if learners are able to abstract metacognitive tactics, it seems likely they would need to have multiple exposures to different tasks in which they struggled with and succeeded with the metacognitive purpose. For instance, having had experiences in

which task perceptions were well aligned and misaligned with the professor's expectations might bring the importance of understanding the task to the attention of the learner. The learner may then engage tactics purposely to address that regulatory process.

While some have proposed discarding the idea of transfer of learning (Carragher & Schliemann, 2002; Hager & Hodkinson, 2009; Tuomi-Grohn et al., 2003), new views on transfer are redefining transfer. A renewed focus on exploring mechanisms of transfer is taking place within the transfer of knowledge literature (Engles, 2012; Goldstone & S. Day, 2012) and researchers are attempting to address critiques of traditional transfer research. This new line of thinking acknowledges learners have internal representations of the material that impacts (a) similarities perceived by learners between tasks, and (b) the actual material that is applied to the transfer task (Chi & Van Lehn, 2012; Lobato, 2012; Marton, 2006). Perkins and Salomon (2012) recently suggested transfer requires learners to (a) detect a relationship between two situations, (b) choose to further investigate this relationship, and (c) figure out the connection and what it means for the new situation. What this means is transfer is no longer considered rote application of knowledge exactly as it is learned; transfer *is* adaptation.

Perkins and Salomon's (2012) detect-elect-connect model can be applied to SRL transfer in terms of how learners detect and make sense of connections between the conditions of two different tasks. The difference between their model and the application to SRL is that Perkins and Salomon's focus remains on knowledge of content (i.e., the *what* of transfer is domain knowledge) and the connections between tasks tend to focus on the task itself (i.e., external conditions). In examining transfer of SRL, external conditions may be one source of connection between two tasks, but connections may also be found in external

Figure 2. Application of Perkin and Salomon's (2012) detect-elect-connect model to domain knowledge and metacognitive knowledge.



evaluations or metacognitive evaluations (see Figure 2). An additional difference between Perkins and Salomon's model and the application of the model to SRL is that conditions in SRL are situated within the COPES model (Winne, 1997). This accounts for the relation between conditions and the rest of the SRL processes that model how learning occurs. This takes into account the complex influence of multiple conditions and relates conditions to other regulatory processes at both micro (e.g., operations, standards) and macro levels (e.g., task understanding, evaluating). Research examining transfer of regulation from this perspective is virtually non-existent and the model of SRL provides a place to start exploring how learners adapt metacognitive strategies for use in novel situations.

Using Winne's (1997) COPES model as a framework highlights several issues that are important to understand: (a) how learners decide on the most salient aspects of a situation to combine into IF statements, (b) how learners sample from a wide variety of previous experiences, and (c) how learners adapt previously used tactics for the situation at hand. Considering the implicit nature of much of SRL (Winne, 2011), understanding learners' perceptions of their conditions presents a challenge for the field. Methodologies such as think-aloud protocols or video-stimulated recall may help elucidate some of the intricacies of learners' decision making around regulatory choices. Much has been written about strengths and weaknesses of different approaches to measuring SRL (cf., Winne & Perry, 2000; Winne, 2014) and appropriate measurement of SRL is critical for beginning to understand how learners draw on their previous regulatory experiences. Research on transfer of knowledge using an actor-oriented perspective such as Lobato, Rodehamel, and Hohensee (2012) and Carraher and Schliemann (2002) may serve as useful guides for examining SRL across tasks and contexts.

## Conclusions

My original interest in transfer of SRL stemmed from wanting to explain the benefits of sport for life. I quickly realized the implications of this idea reached much more broadly than this. The focus of education is shifting from acquiring knowledge to developing skills for learning. The ability to learn independently and to be flexible in overcoming challenges is considered a key competency for success in the 21<sup>st</sup> century (e.g., Canadians for 21<sup>st</sup> Century Learning & Innovation, 2012; Ananiadou & Claro, 2009; Premier's Technology Council of British Columbia, 2010). In a knowledge economy where many ideas and concepts are apparently constantly changing, successful individuals need to know how to learn and how to effectively navigate challenges. SRL is the quintessential skill of the 21<sup>st</sup> century. Being able to guide learners in developing and transferring SRL skills has potential for supporting success in classrooms, playing fields, and beyond.

The implications of this dissertation research are threefold. First, while much research has focused on the importance of and development of SRL in academics (Zimmerman, 2008), sport is a domain that requires and may develop SRL as well. Other learning domains, such as music, also have potential for developing SRL (e.g., McPherson & Renwick, 2001, 2011). While education is unarguably critical for democracy and for success in knowledge-based economies, skills needed for learning and productively facing challenges may develop in other domains, complementing SRL development in education. Whether large amounts of time commitment and elite levels of performance are necessary to reap SRL benefits is still unclear. Feldman and Matjasko's (2005) finding that sport participation within school setting has academic benefits suggests perhaps elite status is unnecessary, but whether the benefits are due to SRL development is yet unknown.

Second, because academics are not the only contexts in which learners can develop SRL processes, support for struggling students may lie in developing and drawing upon experiences in other learning domains. Domains such as sport potentially may be ideal for these regulatory learning experiences because (a) the athlete is interested and motivated for sport and (b) sport provides a learning environment that supports regulation by having more immediate feedback and close relationships with coaches. The extent to which each of these variables matters is still unclear. Third, this line of inquiry may have important implications for developing supports for transfer across seemingly disparate learning domains. Developing these supports requires better understanding of how learners apply and adapt learning processes for different domains. Understanding this will allow us to support transfer of SRL from sport to academics, from academic to work, from work to parenting, from parenting to sport, etc. The future is ripe with possibilities for both research and practice.

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## Appendix A: Participant Consent Form (Evaluating Student Learning)



UVic

# Participant Consent Form



Department of Educational  
Psychology & Leadership Studies

Technology Integration and  
Evaluation Research Lab

### Evaluating Student Learning and the ED-D101 Course

You are invited to participate in a study entitled *Evaluating Student Learning and the ED-D 101* course that is being conducted by Dr. Allyson Hadwin (Principal Investigator). Dr. Hadwin is a Faculty member in the department of Educational Psychology and Leadership Studies at the University of Victoria. This research is being funded by the Social Sciences and Humanities Research Council of Canada (SSHRC-INE grant), the University of Victoria (LTCDG), and the Canadian Foundation for Innovation (CFI-LOF).

#### **Purpose, Objectives, and Importance of Research**

This research project will examine: (a) how students who have taken ED-D101 compare with students who have not according to standard performance indicators collected by Institutional Planning and Analysis, (b) how students self-regulate their learning and use of strategies during the course. Research of this type is important because it will inform: (a) evidence based decision making regarding future offerings, expansion of the course, course content and course activities, and (b) advance theory and research in educational psychology by informing understandings about how students learn to strategically regulate their learning over time.

#### **What does participation in this study involve**

You are being asked to participate in this study because you are enrolled in the course ED-D 101: Learning strategies for University success. All data examined in this research are part of your regular course activities. We are requesting permission only to analyze and review this data for research purposes after the course is completed and your final grades have been submitted. If you agree to voluntarily participate in this research, your participation will include allowing us to analyze for research purposes:

- information you produce as part of your regular course activities (e.g., self-assessment questionnaires, written assignments, computer based discussions)
- course based studying activities when using the gStudy software to complete course readings and assignments, provided you have agreed to have that information recorded when you first login to use the software
- institutionally collected performance indicators such as entering GPA, yearly GPA, exit surveys, will be examined for the entirety of your undergraduate degree. Data will be anonymized.

### **Risks and Benefits**

There are no known or anticipated risks to participating in this research. By participating in this research, you will provide invaluable information that will be used to improve the course and its value for future undergraduate students. The potential benefit is that this course evaluation will lead to: (a) improving the course design, (b) making evidence-based decisions about the future of the course, and (c) improving our understandings about how students learn to self-regulate their learning over the course of a semester.

### **Voluntary Participation**

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at the end of the course without any consequences. Consent forms will be made available in paper copy at the beginning of the course, and electronically at the end of the course. At the end of the course you can login in to either add consent that you did not provide at the beginning of the course, or withdraw consent.

### **Anonymity and Confidentiality**

Since data consists of course assignments and activities, they will be saved/recorded with identifying information (your name and student number). Therefore data will not be anonymous. However, we will protect confidentiality in the following ways: (1) Data will be summarized and stored in a spreadsheet that will identify participants by a random case number rather than name or student ID. (2) Data reported in publications and presentations will be: (a) summarized across students, or (b) presented using pseudonyms in cases where specific examples are used.

### **Researcher's Relationship with Participants**

Dr. Hadwin is your course instructor so she will leave the room when you complete the consent forms. Consent forms will be placed in a sealed envelope and delivered directly to the Dean of Education's office where they will be kept until Dr. Hadwin has submitted your final course grades. Therefore, Dr. Hadwin will not know if you have or have not consented to participate in the research until she is no longer your course instructor.

### **Analysis of Data and Dissemination of Results**

Data will be analyzed by Dr. Hadwin and collaborators on her research project. Findings from this study will be shared in academic publications and presentations, a web bulletin on the TIE website, graduate student thesis work, and reports to senior administrators and undergraduate instructors. Examples from student work will be used in future ED-D101 course offerings but all identifying information will be removed from those examples.

### **Disposal of Data**

Data from this study will be kept for approximately 10 years as it is part of a longitudinal evaluation of the ED-D101 course and its influence on student performance at University. Paper based data will be stored in a locked filing cabinet in the TIE research lab (A210D MacLaurin) after which it will be shredded. Electronic data will be archived and stored anonymously on a password protected server accessible to the researchers. After approximately 10 years the electronic files will be erased.

**Contacts**

You may contact the following people if you have further questions, comments, concerns or wish to verify information about the study:

- (1) During the course: Mika Oshige (
- (2) mikao@uvic.ca), or Dr. Ted Riecken (deaneduc@uvic.ca)
- (3) After the course: Dr. Allyson Hadwin (hadwin@uvic.ca)
- (4) Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

---

*Name of Participant*                      *Signature*                      *Date*

I am willing to be contacted for a follow up interview after the completion of the course and can be contacted as follows:

Email: \_\_\_\_\_

Phone: \_\_\_\_\_

***A copy of this consent will be emailed to you and a paper copy will be taken by the researcher.***

## Appendix B: Participant Consent Form (Evaluating Athlete Learning)



UVic

# Participant Consent Form



Department of Educational  
Psychology & Leadership Studies

Technology Integration and  
Evaluation Research Lab

### Evaluating Athlete Learning

You are invited to participate in a study entitled *Evaluating Athlete Learning* that is being conducted by Lindsay McCardle (Principal Investigator). Lindsay is a graduate student in the department of Educational Psychology and Leadership Studies at the University of Victoria, in Canada. This research is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC).

#### **Purpose, Objectives, and Importance of Research**

This research project will examine how athletes self-regulate their learning and use strategies during their sport training and their academic learning. Research of this type is important because it will inform: (a) evidence-based practice for aiding athletes and students in strategic learning, and (b) advance theory and research in educational psychology by informing understandings about how students learn to strategically regulate their learning in sport training contexts.

#### **What Does Participation in this Study Involve?**

Participation will involve meeting three times. First, there will be an interview about your learning in your sport and academics. In between, you will complete a brief journal of your sport training and your academic learning for five days. Second, there will be a video recording of a training session, following which we will review the video and you will be asked to describe your thinking as you completed the training session (sport observation). Finally, there will be a video recording of a study session, following which we will review the video and you will again be asked to describe your thinking as you completed the study session (academic observation).

#### **Risks and Benefits**

There are no known or anticipated risks to participating in this research. The potential benefit is that this research will lead to improving our understandings about how students learn to self-regulate their learning in sport contexts.

#### **Voluntary Participation**

Your participation in this research must be completely voluntary. You may withdraw at any time during the study without consequence. If you decide to withdraw partway through, it will be your decision whether or not to allow us to use the data already collected or to dispose of it.

#### **Anonymity and Confidentiality**

Since data consists of audio and video recordings, data will not be anonymous. However, we will protect confidentiality in the following ways: (1) Audio files and transcribed interviews will be stored and labeled using random case number rather than name or student ID. (2) Data reported in publications and presentations will be

(a) summarized across students, or (b) presented using pseudonyms in cases where specific examples are used.

### **Analysis of Data and Dissemination of Results**

Data, including video data, will be analyzed by Lindsay McCardle and collaborators on her research project, under the supervision of Dr. Allyson Hadwin. Findings from this study will be part of Lindsay McCardle's PhD dissertation. Findings will be shared in academic publications and presentations, a web bulletin on the TIE website, graduate student thesis work, and reports to senior administrators and undergraduate instructors.

### **Disposal of Data**

Data from this study will be kept for approximately 5 years. Paper based data will be stored in a locked filing cabinet in the TIE research lab (A210D MacLaurin) after which it will be shredded. Electronic data, including video data, will be archived and stored anonymously on a password protected server accessible to the researchers. After approximately 5 years the electronic files will be erased.

### **Contacts**

You may contact the following people if you have further questions, comments, concerns or wish to verify information about the study:

- (1) Lindsay McCardle (mccardle@uvic.ca)
- (2) Dr. Allyson Hadwin (hadwin@uvic.ca)
- (3) Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca)
- (4) Dr. Marije Elferink-Gemser (m.t.elferink-gemser@umcg.nl)

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers. Your signature below indicates that you consent to participate in all four activities of this research project, including being video-taped: sport interview, sport observation, academic interview, academic observation.

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*Name of Participant*

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*Signature*

---

*Date*

**Visually Recorded Images/Data** Please initial below if you agree to have your videos used when results are shared (e.g., at conferences, online). Please note that your name will not be used, however you may be recognizable in the video images.

Initials \_\_\_\_\_

***A copy of this consent will be emailed to you and a paper copy will be taken by the researcher.***



## Manuscripts



# Self-regulated learning in sport and academic domains for competitive youth athletes

Lindsay McCardle, Laura Jonker, Marije T. Elferink-Gemser, & Chris C. Visscher

McCardle, L., Jonker, L., Elferink-Gemser, M. T., & Visscher, C. C. (2014). *Self-regulated learning in sport and academic domains for competitive youth athletes*. Manuscript in submission.

## Abstract

Athletes have evidenced high levels of achievement in academics as well as in their sport. Self-regulated learning (SRL), consisting of metacognition and motivation, is important for success in both domains and has been suggested as a key link between sport and academics. We aimed to (a) examine the relationship between self-reported levels of SRL in academics and sports, and (b) investigate whether there are differences between levels of SRL engagement in these two domains. Dutch competitive youth athletes ( $N = 215$ ) responded to each item of the Self-Regulated Learning – Self-Report Scale twice: once for the academic domain and once for the sport domain. Models of strong factorial invariance across six subscales were accepted. High, positive correlations were found between subscale scores in sport and academics indicating athletes who reported high engagement of SRL in sport also report high engagement in academics. Further, latent mean differences revealing higher self-reported engagement of regulatory processes in sports than in academics. Findings point to the importance of motivation in SRL and suggest there may be important differences in learning contexts that support motivational and regulatory engagement.

*Keywords:* self-regulation; sports; academics; learning; athletes

## Introduction

In the United States, academic benefits linked with sport participation include higher academic achievement, lower drop out rates, higher educational aspirations, and more time spent on homework (Broh, 2005; Busch, Loyen, Lodder, Schrijvers, van Yperen, & de Leeuw, 2014; Feldman & Matjasko, 2005; Fredericks & Eccles, 2006; Marsh & Kleitman, 2003). Eccles and Barber (1999) proposed benefits of extra-curricular participation are mediated by engagement in a social network with other students, while Marsh (1992) suggested student-athletes have enhanced school identities, involvement, and commitment leading to improved academic performance. These two theories focus on benefits of sport participation in school-based sports. However, European youth athletes, whose sports are club based rather than school based, also have a similar link with academic performance. Richartz and Brettschneider (cited in Brettschneider, 1999) reported German adolescent, elite athletes had higher grades in German language and mathematics class, as well as higher levels of intent to attend university than non-athletes. Talented youth athletes in the Netherlands, where level of secondary schooling is an important predictor of academic prospects, were registered in the highest level of the secondary education system at a much greater percentage than the national average (Jonker, Elferink-Gemser, Toering, Lyons, & Visscher, 2010; Jonker, Elferink-Gemser, & Visscher, 2009). Thus, benefits of sport participation are likely to include factors other than identifying with school because European youth sports are not school based. Further, European research has focused on high-level athletes rather than simply participation at any level.

Based on athletes' academic success, Jonker et al. (2009) proposed athletes develop self-regulated learning (SRL) competencies that are helpful in sport as well as in school. SRL refers to the proactive engagement of learners in their own learning by planning, monitoring, and adapting towards goal achievement (Hadwin & Winne, 2011; Schunk & Zimmerman, 1994; Zimmerman, 1986, 1989). Regulation involves control of cognition, behaviour, and motivation/affect; metacognitive monitoring and evaluating are critical in order for learners to adapt, experiment, and persist with learning. SRL involves several key processes: (a) planning, the ideas a learner has for approaching the task including understanding what is being asked of them, setting goals, and creating a plan of action (Winne & Hadwin, 1998); (b) self-monitoring, checking one's current performance, often covertly (Zimmerman, 2000); (c) evaluating, comparing of the current state to the standards a learner has set (Zimmerman, 2000); and (d) reflecting, considering of past experiences after the task to position the learner for future learning (Ertmer & Newby, 1996). Because SRL is effortful, self-regulated learners need to be motivated to engage with tasks (Winne & Hadwin, 2008). Self-regulated learners demonstrate high levels of effort, a motivational outcome that needs to be sustained to reach optimal levels of performance (Ericsson, Krampe, & Tesch-Römer, 1993), and high levels of self-efficacy, beliefs that they are able to complete the task (Bandura, 1977).

Indeed, compared with novice athletes, experts have been shown to have more sophisticated regulatory processes including more specific goals and self-evaluation, strategies that focus on technique rather than effort, and adaptive motivational beliefs (Anshel & Porter, 1996; Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002; Toering, Eflerink-Gemser, Jordet, & Visscher, 2009). Adaptive emotion regulation patterns have been linked with improved sport performance (Calmeiro & Tenenbaum, 2007; A. Cohen, Tenenbaum, & English, 2006; Prapavessis, Grove, McNair, & Cable, 1992) and athletes evidence regulation by modifying goals according to discrepancies between current goal and performance (Donovan & Williams, 2003; Williams, Donovan, & Dodge, 2000). Further, Cleary, Zimmerman, and Keating (2006) reported a short training session in self-regulatory processes improved basketball free-throw performance.

These same regulatory processes are important for academic success as well. Successful students demonstrate use of metacognitive processes such as planning and reflecting (Veenman & Spaans, 2005), differentiate choices in tactics, goals, and resources based on the assigned task (Hadwin, Winne, Stockley, Nesbit, & Woszczynna, 2001), and engage in goal setting and monitoring (Kitsantas, 2002). Interventions geared towards increasing SRL processes, such as self-monitoring, have resulted in improved performance compared to control groups (Lan, 1996; Schmitz & Perels, 2011).

Models of SRL (e.g., Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000) recognize contextual elements influence learners' metacognitive and regulatory processes, so that what planning looks like in science might be different than planning in English. Although the generality of regulatory processes across learning domains is still unclear (Alexander, Dinsmore, Parkinson, & Winters, 2011), there is some support for the idea that if learners plan and monitor in one academic class they are also more likely to also do so in another class (e.g., Adey & Shayer, 1993; Metallidou & Vlachou, 2007; Veenman, Elshout, & Meijer, 1997; Veenman, Wilhelm, & Beishuizen, 2004). For example, students who were taught to plan in economics demonstrated better planning in statistics class (Masui & De Corte, 1999). Jonker and colleagues' (2009) hypothesis extends this possibility to sports domains. If learners plan and monitor in swim practice, are they also more likely do so in statistics class? Planning to focus on

the rhythm of the flutter kick is different than planning how to study for a statistics midterm, however the regulatory purpose of these two actions appears similar: a metacognitive plan of how to approach the task at hand. This aligns with the view suggested by Perkins and Salomon (1989) that general cognitive, or in this case, metacognitive, skills exist, but they are always applied in contextualized ways, such as in sport or academic tasks.

Evidence to date supports the importance of SRL in both academic and sport learning domains (Jonker, Elferink-Gemser, & Visscher, 2011) and theory suggests regulatory processes are general skills applied to specific contexts (Perkins & Solomon, 1989), yet no research to our knowledge has investigated the relationship between how a learner regulates in sport and how he or she regulates in academics. Jonker et al. (2010) reported that compared with age-matched controls, elite youth soccer players in the Netherlands self-reported higher levels of regulatory engagement, but because the authors used a domain-general measure of SRL, it is unclear whether the difference of SRL engagement was in sport or in academics or both. In the present study, we aim to assess the relationship between self-reported engagement of SRL processes in sport and academic learning. Specifically, we look at six elements of SRL: four metacognitive processes (planning, self-monitoring, evaluating, and reflecting) and two motivational aspects (effort and self-efficacy). Two research questions were investigated: (a) are self-reported scores of SRL and motivational processes related in sport and academic learning? and (b) are there differences in SRL engagement and motivational aspects in these two domains? We hypothesized that regulatory processes and motivational aspects would be related in sport and academic domains, but we had no hypotheses about the differences between these two domains.

## **Methods**

### **Participants**

Participants were 244 Dutch competitive youth athletes with a mean age of 14 years ( $sd = 1.54$ ). Sixty percent of the sample was male. Thirteen participants were removed from analysis due to missing data. An additional 16 participants were removed due to the “alternative” nature of their sport; i.e., participants were athletes in sports such as kickboxing or sport acrobatics, which are less popular and may have less stringent standards to be considered high-level competitive athletes and may not have been part of the population of high-level competitive athletes from which we intended to sample. Thus, a final sample of 215 youth athletes was analyzed. Participants were involved in a large variety of competitive sports in both team (e.g., field hockey, soccer, handball;  $n = 128$ ) and individual (e.g., athletics, tennis, gymnastics;  $n = 87$ ) sports. Thirty percent ( $n = 65$ ) reported competing at the regional level and 70% ( $n = 150$ ) at the international or national level which means that they belong to the best 2.5% of Dutch athletes in their age category (Netherlands Olympic Committee & Netherlands Sports Federation, 2008). High-level competitive athletes were chosen for this study because based on past research (e.g., Cleary & Zimmerman, 2001) they were expected to have high engagement of SRL in their sport, allowing us to examine whether these athletes also had high engagement in their academic learning.

### **Measures**

The Self-Regulated Learning – Self-Report Scale (SRL-SRS; Toering, Elferink-Gemser, Jonker, van Heuvelen, & Visscher, 2012) was used to assess engagement of regulatory processes. The SRL-SRS is comprised of 46 items in 6 subscales based on critical self-regulatory processes and motivational variables: planning (8 items), self-monitoring (6 items), evaluating (8 items), reflecting (5 items), effort (9 items), and self-efficacy (10 items). Because subscales were drawn from previously existing measures, response scales varied: items for the planning, self-

monitoring, effort, and self-efficacy subscales were scored on a 4-point Likert scale from 1 *almost never* to 4 *almost always*, and these items were presented in mixed order; evaluating items were presented next and answered on a scale from 1 *never* to 5 *always*; reflecting items were presented last and scored on a 5-point Likert scale from 1 *strongly agree* to 5 *strongly disagree*. Reflecting items were reverse scored to correspond to the other five subscale scores. Higher subscale scores indicate higher engagement of regulatory processes or higher levels of motivation. Confirmatory factor analysis in Toering et al. (2012) supported the factor structure and the SRL-SRS has acceptable levels in internal and test-retest reliability. In addition, the validity of the SRL-SRS is supported by significant correlations between SRL-SRS scores and observation of SRL behaviour (Toering, Elferink-Gemser, Jordet, Jorna, Pepping, & Visscher, 2011).

Because our interest was in examining student-athletes' SRL in two different contexts and the SRL-SRS is a domain-general SRL measure, participants were asked to answer each item twice: once in relation to their academic learning and once in relation to their sport learning. Figure 1 illustrates examples of SRL-SRS items and the response scales as presented to participants. All subscales had acceptable levels of Cronbach's alpha reliability in this sample ( $\alpha > .7$ ; Nunnally and Bernstein, 1994).

Figure 1. Examples of SRL-SRS items and the response scales as presented to participant.

	Sport				School					
I determine how to solve a problem before I begin. [planning]	1 almost never	2	3	4 almost always	1 almost never	2	3	4 almost always		
While doing a task, I ask myself, how well I am doing. [self-monitoring]	1 almost never	2	3	4 almost always	1 almost never	2	3	4 almost always		
I am confident that I could deal efficiently with unexpected events. [self-efficacy]	1 almost never	2	3	4 almost always	1 almost never	2	3	4 almost always		
I concentrate fully when I do a task. [effort]	1 almost never	2	3	4 almost always	1 almost never	2	3	4 almost always		
I stop and rethink a step I have already done. [evaluating]	1 never	2	3	4	5 always	1 never	2	3	4	5 always
I try to think about how I can do things better next time. [reflecting]	<input type="checkbox"/> 1 strongly agree	2	3	4	5 strongly disagree	<input type="checkbox"/> <input type="checkbox"/> 1 strongly agree	2	3	4	5 strongly disagree

## Procedure

All procedures were in accordance with ethical standards of the leading institution, which conform to the World Medical Association Helsinki Declaration. Participants were recruited from secondary schools in the Netherlands. The school governing bodies and parents were approached in writing and gave their consent. In a group setting with a test-leader present, athletes completed the SRL-SRS individually. Completion of the SRL-SRS took approximately 25 minutes.

## Statistical Analysis

Models of factorial invariance were estimated to test the assumption that measures are equal across time and across samples (Meredith, 1993), or in this case across domains. Without evidence for factorial invariance, differences between samples or across time (or domains) can be due to changes in the factor weightings of the subscales rather than in the construct itself. Three levels of factorial invariance were examined: (a) the *configural baseline* provides a model for comparison where the same items are constrained to load on a factor in the sport and academic contexts, but the regression-loadings are free to vary; (b) the model of *weak factorial invariance* constrains item factor loadings to be equal in the sport and academic contexts; and (c) the model of *strong factorial invariance* constrains factor loadings and item intercepts to be equal across domains. Baseline, weak, and strong factorial invariance models were run separately for each SRL-SRS subscale, using ML estimation. Goodness of fit was assessed using the following indices and their suggested acceptable values:  $p$ -value for  $\chi^2$  statistic ( $ns$ ; Kline, 2010), comparative fit index ( $CFI \geq .90$ ; Kline, 2010), the Tucker-Lewis index ( $TLI \geq .95$ ; Byrne, 2001), standardized root mean square residual ( $.00 \leq SRMR \leq .05$ ; Byrne, 2001), and root mean square error of approximation ( $.00 \leq RMSEA \leq .05$ ; Kline, 2010).

To answer our first research question about the relationship between self-regulatory processes and motivational variables, we ran correlations between factors within the model of strong factorial invariance. Cohen (1988) suggested correlations of .10 be considered small, .30 moderate, and .50 large. Hemphill (2003) cautions that when considering two self-report measures, correlations will tend to be higher. Thus, we considered small, medium, and large correlations to be .20, .40, and .60, respectively.

To answer our second research question about the differences in engagement between sport and academic contexts, we examined latent mean differences within the model of strong factorial invariance. Academic factor means were constrained to 0 making the academic context the reference context; sport factor means were freely estimated, reflecting the deviation from the reference mean. Positive differences represent higher mean scores on sport factors.

## Results

Means and standard deviations for academics and sport SRL-SRS items can be found in Appendix A. In the baseline configural model, the *planning* subscale had a poor fit with one item that had a very low loading (.142) in the sport context: “I determine how to solve a problem before I begin”. It is possible that participants did not feel this was as relevant in a sport situation. The *evaluating* subscale had a moderate fit of the baseline model with one particularly low correlation between sport and academic contexts ( $r = .042$ ) of the item “I check to see if my calculations are correct”. Again, this particular item seems less relevant to sport. Because dropping these items resulted in better model fit and because it seemed theoretically plausible that these items did not fit with other sport items, they were removed from analysis.

Model fit indices for configural, weak, and strong models of factorial invariance are found in Table 1. Though chi-square statistics were significant for all of the configural models,

the remaining statistics indicated acceptable fit. All subscales demonstrated significant differences in chi-square statistics, indicating poorer fit of the more stringent models for at least one of weak model relative to configural and strong model relative to weak. Inspection of RMEAS and other relative fit statistics did not show major changes, thus we accepted models of strong factorial invariance and proceeded with the remaining analyses.

Correlation estimates and latent mean differences for each SRL-SRS factor are found in Table 2. Moderate ( $r > .4$ ) to high ( $r > .6$ ) factor correlations estimated in the model of strong factorial invariance support our hypothesis of a positive relationship between SRL engagement in sport and academics. This suggests participants who had high engagement of regulatory and motivational processes in sport also had high engagement in academics. Latent mean differences consistently demonstrated self-reported sport factor means were significantly higher than academic factor means. This suggests that on average, participants reported higher engagement of self-regulatory and motivational processes in sport than in academic contexts.

Table 1

*Model Fit Indices for Factorial Invariance Models for each SRL-SRS Subscale (N = 215)*

Model	$\chi^2$	df	$\chi^2$ diff	df diff	RMSEA	CFI	TLI	RMSR
<b>Planning</b>								
Configural	117.62	69			0.057	0.967	0.957	0.041
Weak	124.29	75	6.67	6	0.055	0.967	0.960	0.050
Strong	147.95	81	23.66*	6	0.062	0.955	0.950	0.070
<b>Self-monitoring</b>								
Configural	80.81	47			0.058	0.966	0.952	0.042
Weak	98.90	52	18.09*	5	0.065	0.953	0.94	0.070
Strong	122.11	57	23.21*	5	0.073	0.932	0.924	0.109
<b>Evaluating</b>								
Configural	149.16	69			0.074	0.947	0.930	0.053
Weak	150.77	75	1.60	6	0.069	0.950	0.939	0.056
Strong	179.54	81	28.77*	6	0.075	0.935	0.927	0.087
<b>Reflecting</b>								
Configural	43.22	29			0.048	0.991	0.986	0.038
Weak	51.35	33	8.13	4	0.051	0.988	0.984	0.057
Strong	66.74	37	15.39*	4	0.061	0.981	0.977	0.072
<b>Effort</b>								
Configural	257.48	125			0.07	0.918	0.9	0.058
Weak	281.18	133	23.70*	8	0.072	0.909	0.895	0.088
Strong	286.99	141	5.81	8	0.069	0.910	0.902	0.094
<b>Self-Efficacy</b>								
Configural	238.62	159			0.048	0.955	0.946	0.05
Weak	254.07	168	15.46	9	0.049	0.951	0.945	0.059
Strong	271.33	177	17.26*	9	0.050	0.947	0.943	0.065

a. Planning subscale without item "I determine how to solve a problem before I begin"

b. Evaluating subscale without item "I check to see if my calculations are correct"

\*  $p < .05$

Table 2

*Correlations estimates and latent mean difference estimates for SRL-SRS factors (N = 215)*

<b>SRL-SRS Subscale</b>	<b>Sport <i>M</i> (SD)</b>	<b>Academic <i>M</i> (SD)</b>	<b><i>r</i></b>	<b>Sport <i>M</i> (relative to academic <i>M</i>)<sup>a</sup></b>
Planning	3.03 (.63)	2.58 (.59)	.80	0.79**
Self-monitoring	3.23 (.59)	2.72 (.58)	.70	1.00**
Evaluating	3.97 (.71)	3.53 (.65)	.72	0.79**
Reflecting	4.37 (.80)	3.94 (.71)	.82	0.66**
Effort	3.56 (.46)	2.83 (.61)	.47	1.26**
Self-efficacy	3.30 (.48)	2.89 (.50)	.70	0.90**

a. *Planning, self-monitoring, effort, and self-efficacy* subscales are scored from 1-4, and *evaluating and reflecting* subscales are scored from 1-5.

\*  $p < .05$ ; \*\* $p < .01$

### Discussion

The present study examined the relationship between SRL in sport and academic domains. First, the results showed competitive youth athletes who report high engagement of SRL processes of planning, self-monitoring, evaluating, and reflecting in sport also reported high engagement of SRL in academic learning, as hypothesized. Although to a lesser extent, this was also true of the motivational variables of effort and self-efficacy: athletes who reported high levels of motivation in sport also reported high levels of motivation in school settings. High correlations between regulatory and motivational processes suggest that SRL may indeed be a link between success in sport and academics as put forth by Jonker and colleagues (2009) though this provides no evidence of causation. Of note, *effort* was the only subscale with a moderate correlation, lower than .7, suggesting athletes who invest high levels of effort in sport do not necessarily do so in academics. That high-level athletes would have low levels of motivation for school is not surprising considering a substantial amount of research on motivation in education (e.g., Falco, Summers, & Bauman, 2010; Harackiewicz, Rosek, Hulleman, & Hyde, 2012; McCann & Turner, 2004; Wolters & Rosenthal, 2000) suggests motivation is low in educational settings for the general population of students. Without a control group of non-athlete students, we cannot say whether motivation levels indicated by self-reported effort and self-efficacy are lower for student-athletes in this sample relative to non-athlete students. Subscale mean for effort in academic was 2.83 ( $SD = 0.61$ ) on a 4-point Likert scale, suggesting that although lower than sport, effort in academics may not be a concern. Considering the high level of competition of participants in this study, we assume sport is a setting in which athletes strive to be their best. In academics, however, students may not necessarily be aiming to receive top grades. Indeed, the culture around education in Holland is one of that recognizes the average student is the norm and “most Dutch students are satisfied when they score 60-70% on an exam” (Rienties & Templaar 2013, p. 198). Yet, this does not necessarily only apply to Dutch students and it is critical to take learners’ own goals into account when studying SRL (Boekaerts, 1995), because it is based on their own personal goals that learners make regulatory decisions. We recommend future research on SRL in sport and academic settings gather data on student-athletes’ overall goals in each context.

Second, the results demonstrated that competitive youth athletes reported higher engagement of SRL in their sports training than in their academic learning. As little research has investigated the relationship between regulatory processes in these two contexts, we had no hypotheses about differences in the extent to which student-athletes would engage these processes. Results were clear that across all subscales, student-athletes reported more engagement of regulatory and motivational processes. Coupled with the finding that *effort* correlation across sport and academics was lower than for self-efficacy or any regulatory processes, this suggests motivation is critical for engaging regulatory processes. This is consistent with SRL theories that highlight the importance of motivation for the effortful process of regulation (e.g., Boekaerts, 1995; Schunk & Zimmerman, 1994; Winne & Hadwin, 2008). Both interest (Hidi & Harackiewicz, 2000) and autonomy (e.g., Ryan & Deci, 2000) are related to motivation and that athletes chose the particular sport they participate in may suggest athletes have some autonomy and interest in choosing their sport contributing to higher levels of motivation. Further, elite levels of competition like participants in this study undertook assume athletes to be pursuing their best possible performance, which would suggest high levels of value for regulating performance.

Based on these findings, we hypothesize that in addition to higher levels of motivation for sport relative to academics, sports may offer an ideal context for self-regulation. For example sports training may support regulation by having concrete goals and outcomes that make evaluations clear and inviting regulation. These outcomes are also often short-term in nature and athletes can get immediate feedback that provides regular chances for evaluation. Academic learning is more difficult to assess because it is more abstract and outcomes, in the form of grades, are often irregular and delayed, providing few opportunities learners to receive external feedback. Further, in sport coaches can play the role of co-regulator (Hadwin, Järvelä, & Miller, 2011) providing guidance in planning, enacting, and evaluating tasks including providing regular feedback whereas teachers do not always have the opportunity to develop this kind of relationship with their students.

This research presents an important first step in examining student-athletes' SRL in different domains. However, we draw attention to two limitations that are important to consider. First, distributions were not normal, as most athletes reported fairly high levels of SRL in both domains and especially in sport. Considering the link between SRL and success in sport (Jonker, 2011) and that seventy percent of our sample competed at the national level or higher as youth athletes, high levels of self-reported SRL were expected. Nevertheless, this may have influenced the results and we recommend further investigation of the link between sport and academics in all levels of athletes. Second, measurement of SRL in this study used an aptitude measure (Winne & Perry, 2000) that was designed to be a domain-general measure but was used as a more context-specific measure in this case. Further, the context of sport was much more specific for these athletes who generally specialized in one sport compared to in academics, where they may be thinking about math, science, Dutch language, or social sciences tasks. Correlations between sports and academic might be stronger for academic subjects for which student-athletes consider themselves successful or competent relative to subjects with which student-athletes struggle and this provides an interesting area for future research. Measurement of SRL also relied solely on self-report data, which are often considered unreliable (Winne & Jamieson-Noel, 2002, 2003; Winne, Zhou, & Egan, 2011). However, Toering et al. (2011) reported positive relations between SRL-SRS scores and observable behaviour of athletes on the soccer pitch. In addition, a strength of the measurement format was that participants answered items related to

both domains at the same time which minimized the effects of experiences between measurement occasions. The format also encouraged learners to actively differentiate how they regulate in school and in sport. In future studies, researchers should consider using self-report data combined with more objective and task-specific measures of SRL, such as observation, and/or more nuanced self-report measures, such as diaries or microanalytic approaches (Cleary, 2011).

Further research on SRL across learning domains is warranted. Qualitative profiles of learners' regulation in both sport and academic domains would provide a richer examination of similarities and differences in regulation across domains. Research is also needed to examine whether the relationship between SRL in different domains depends on other variables, such as sport type or competitive level or level of schooling. More research into if, why, and how sport develops SRL better than academic contexts is also justified. In addition, further research is needed to delve into *how* learners might transfer SRL from one domain to another.

The present results suggest that learners who report high level of SRL in sport are also engaging regulatory processes in academics. This provides preliminary support for the idea that learners might transfer SRL between domains (Jonker et al., 2009) by demonstrating that there is indeed a relationship between SRL in the sport and academic domains. If learners are able to use previous SRL experiences and adapt them to new learning domains, then this could provide an opportunity for intervention to assist struggling learners. For example, teachers and others may be able to help a competitive athlete who is having difficulty in school draw on successful experience where he or she regulated to overcome a struggle or meet a difficult goal in his or her sport training. This SRL connection between sports and academic learning is likely to be a fruitful avenue for research and practice.

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Appendix  
SRL-SRS Items, Means and Standard Deviations for Sport and Academic Contexts

Item	Scale	Sports		Academics	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
I determine how to solve a problem before I begin. <i>[dropped]</i>	PL1	2.93	.867	2.74	.782
I think through in my mind the steps of a plan I have to follow.	PL5	3.15	.854	2.66	.850
I ask myself questions about what a problem requires me to do to solve it, before I do it.	PL11	2.89	.850	2.47	.790
I imagine the parts of a problem I still have to complete.	PL17	2.90	.911	2.48	.819
I carefully plan my course of action to solve a problem.	PL20	2.79	.941	2.35	.868
I figure out my goals and what I need to do to accomplish them.	PL27	3.43	.693	2.91	.774
I clearly plan my course of action to solve a problem.	PL31	2.94	.854	2.50	.814
I develop a plan for the solution of a problem.	PL35	3.10	.779	2.68	.781
I check how well I am doing when I solve a task.	SM7	3.28	.801	2.75	.797
I check my work while doing it.	SM12	3.13	.853	2.68	.850
While doing a task, I ask myself, how well I am doing.	SM18	3.11	.908	2.68	.833
I correct my errors.	SM24	3.61	.577	3.04	.775
I check my accuracy as I progress through a task.	SM30	3.02	.864	2.54	.830
I judge the correctness of my work.	SM37	3.23	.833	2.59	.875
I look back and check if what I did was right.	EV1	4.08	.748	3.54	.846
I double-check to make sure I did it right.	EV2	4.04	.819	3.60	.825
I check to see if my calculations are correct. <i>[dropped]</i>	EV3	3.78	1.038	3.76	.921
I look back to see if I did the correct procedures.	EV4	4.19	.829	3.60	.951
I check my work all the way through the problem.	EV5	3.91	.905	3.42	.938
I look back at the problem to see if my answer makes sense.	EV6	3.83	.995	3.49	.985
I stop and rethink a step I have already done.	EV7	3.40	1.026	3.21	.901
I make sure I complete each step.	EV8	4.35	.783	3.83	.797
I reappraise my experiences so I can learn from them.	REF1	4.32	.903	3.85	.818
I try to think about my strengths and weaknesses.	REF3	4.45	.879	3.95	.958
I think about my actions to see whether I can improve them.	REF4	4.52	.885	4.00	.875
I think about my past experiences to understand new ideas.	REF5	4.11	.982	3.80	.908

Item	Scale	Sports		Academics	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
I try to think about how I can do things better next time.	REF6	4.47	.916	4.12	.962
I keep working even on difficult tasks.	EFF3	3.67	.577	2.93	.867
I put forth my best effort when performing tasks.	EFF6	3.80	.442	3.13	.796
I concentrate fully when I do a task.	EFF9	3.48	.716	2.78	.745
I don't give up even if the task is hard.	EFF13	3.65	.720	2.91	.863
I work hard on a task even if it is not important.	EFF15	3.28	.784	2.49	.916
I work as hard as possible on all tasks.	EFF19	3.65	.599	2.90	.880
I work hard to do well even if I don't like a task.	EFF23	3.43	.700	2.62	.898
If I'm not really good at a task I can compensate for this by working hard.	EFF25	3.55	.646	2.97	.799
I am willing to do extra work on tasks in order to learn more.	EFF29	3.48	.669	2.78	.868
I know how to handle unforeseen situations, because I can well think of strategies to cope with things that are new to me.	SE4	3.15	.742	2.77	.737
I am confident that I could deal efficiently with unexpected events.	SE14	3.21	.749	2.82	.728
If I am in a bind, I can usually think of something to do.	SE16	3.22	.757	2.70	.800
I remain calm when facing difficulties, because I know many ways to cope with difficulties.	SE21	3.13	.778	2.78	.801
I always manage to solve difficult problems if I try hard enough.	SE26	3.36	.747	3.00	.788
If I persist on a task, I'll eventually succeed.	SE28	3.60	.595	3.32	.731
It is easy for me to concentrate on my goals and to accomplish them.	SE29	3.47	.682	2.95	.775
I can solve most problems if I invest the necessary effort.	SE32	3.47	.632	3.14	.732
When I am confronted with a problem I usually find several solutions	SE33	3.04	.808	2.57	.775
No matter what comes my way, I'm usually able to handle it.	SE36	3.35	.694	2.88	.776



# Using multiple, contextualized data sources to measure learners' perceptions of their self-regulated learning

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## Abstract

As theory and research in self-regulated learning (SRL) advance, debate continues about how to measure SRL as strategic, fine-grained, dynamic adaptations learners make during and between study sessions. Recognizing learners' perceptions are critical to the strategic adaptations they make during studying, this research examined the unique contributions of self-report data for understanding regulation as it develops over time. Data included (a) scores on the Regulation of Learning Questionnaire (RLQ) completed in the first and last few weeks of a 13-week course and (b) diary-like Weekly Reflections completed over eleven weeks. Participants were 263 undergraduate students in a course about SRL. First, exploratory factor analysis resulted in a five-factor model of the RLQ with factors labeled Task Understanding, Goal Setting, Monitoring, Evaluating, and Adapting. Second, latent class analysis of Time 1 and 2 RLQ scores revealed four classes: *emergent regulators*, *moderate regulators*, *high regulators with emergent adapting*, and *high regulators*. Finally, in-depth qualitative analysis of Weekly Reflections resulted in group SRL profiles based on a sub-sample of participants from each RLQ class. Qualitatively, these groups were labeled: *unengaged regulators*, *active regulators*, *struggling regulators*, and *emergent regulators*. Quantitative and qualitative SRL profiles were juxtaposed and similarities and differences discussed. This paper explicates and discusses the critical importance of sampling self-reports of SRL over time and tasks particularly in contexts where regulation is developing.

**Keywords:** self-regulated learning; self-report data; metacognition

## Introduction

The past two decades have witnessed a proliferation of research on self-regulated learning (SRL). Despite advancements in SRL theory and research, debate continues about how to measure SRL, especially when defined as fine-grained, dynamic adaptations learners make during and between study sessions (Winne and Hadwin 1998). For the most part, self-report instruments have treated SRL as a disposition (Boekaerts and Corno 2005; Winne and Perry 2000). In contrast, SRL can be viewed as a series of events, where each event is a snapshot in time. Measuring SRL as an event means documenting SRL as it occurred in a particular task, context, and study episode.

Attempts to measure SRL as an event, or a series of events, have shifted focus away from self-report inventories and toward observation measures of SRL such as video records and computer-generated traces (or logfiles) of inferred SRL actions (Azevedo et al. 2013; Hadwin et al. 2004, 2007) and think aloud protocols (Azevedo 2005). This shift is due in part to the fact that self-report inventories have failed to capture fine-grained adaptation, in terms of specific learning events or actions that together comprise self-regulatory processes (Boekaerts and Corno

2005; Pintrich et al. 2000; Winne et al. 2002; Winne and Perry 2000). However, consistent with Nelson (1996), we posit self-perceptions are critical for understanding regulatory actions and decisions. Therefore, this study examines the use of two kinds of self-report measures for capturing changes or adaptation in SRL processes over time, highlighting the importance of SRL in context.

### **SRL Framework**

Self-regulated learners take an active approach to learning by planning, monitoring, and adapting in order to reach self-set goals (Boekaerts and Corno 2005; Winne 1997, 2001; Winne and Hadwin 1998; Zeidner et al. 2000; Zimmerman 1986, 1989), and several theoretical models of SRL have been proposed (e.g., Boekaerts 1996, 2006; Boekaerts and Niemivirtu 2000; Pintrich 2004; Winne and Hadwin 1998, 2008; Zimmerman, 1989, 2000). Most SRL models emphasize the importance of strategic approaches to learning that are intentional or goal-driven, and adaptive (Puustinen and Pulkkinen 2001). While each model recognizes the importance of planning, monitoring, and strategically engaging or adapting, they tend to emphasize different facets of SRL. For example, Boekaerts' (1996, 2006) model of adaptable learning is noted for its attention to the interaction between metacognitive, motivational, and emotional control systems. Pintrich (1989, 2000) emphasizes motivation, self-efficacy, and goal orientation as critical features of SRL associated with four phases: forethought, monitoring, control, and reflection. Zimmerman (1989, 2001) models SRL over three phases including forethought, performance, and self-reflection with each phase comprising specific regulatory processes such as: task analysis and self-motivation beliefs during the forethought phase, self-control and self-observation as part of the performance phase, and self-judgment and self-reaction comprising the self-reflection phase.

A limitation of these models is that they emphasize broader aspects of self-regulated learning, rather than detailing specific mechanisms operating across phases and facets of regulation. In contrast, Winne and Hadwin's (1998, 2000) model of SRL details a common cognitive architecture that accounts for interaction of a person's conditions, operations, products, evaluations, and standards (COPES) within and across phases of SRL. "Winne and Hadwin's model complements other SRL models by introducing a more complex description of the processes underlying each phase" (Greene & Azevedo, 2007, p. 335).

Winne and Hadwin (1998) model SRL as unfolding over four loosely sequenced phases of studying. From this perspective, SRL is a recursive cycle in which learners may revisit phases in any order. Metacognitive monitoring and control are central components. In phase 1, learners construct task perceptions that are internal representations of the task at hand. If learners misperceive tasks, their engagement, monitoring, and control are likely to be miscalibrated. Phase 2, goal setting and planning, involves translating task perceptions into specific standards and plans for successful task completion. When learners set specific, clear, proximal goals (McCardle et al. 2013; Zimmerman 2008), opportunities arise for more accurately monitoring and regulating as the task unfolds. In phase 3, learners put their plans into action by engaging tactics and strategies for task enactment. For high quality learning, students must match cognitive processing strategies to the task and to their goals for the task. In phase 4, learners evaluate and adapt their studying. This is the reflective component of SRL wherein learners respond to challenges, shortcomings, and failures during a study episode and into future study episodes. This adaptive process in response to challenge is the essence of productive self-regulation. It requires learners to monitor and evaluate progress against their standards and to actively adapt or revise studying based on those evaluations. Successful learners recognize and

address problems as they study. By being metacognitively aware of their studying, they experiment with methods of learning (Winne 1997, 2011).

Winne and Hadwin (1998) expand on the processes learners engage in each phase of SRL with the COPEs cognitive architecture. *Conditions* are the contexts that surround a learners' work and can be both internal (e.g., cognitions, motivation, and affect) and external (e.g., environment, social aspects). *Operations* are the manipulations of information that create mental products in each phase (i.e., perceptions of the task, goals, plans, task enactment status, and adaptive responses). *Products* are created by operating on information or knowledge. Products from each phase become the conditions for the following phase. *Evaluation* takes place when learners compare products to the *standards* they have set. Learners evaluate and regulate at the level of both phases and tasks. The potential of Winne and Hadwin's model lies in its ability to guide a nuanced and contextualized examination of learning (Greene and Azevedo 2007). This creates a strong foundation for designing and examining the efficacy of a self-report measure of self-regulatory processes sensitive to the ways SRL unfolds and changes over time.

### **Measurement of SRL**

Considering SRL from Winne and Hadwin's (1998) model, three critical aspects influence assessment design. First, regulation unfolds over time; as Winne and Perry (2000) describe it, SRL can be viewed as an event. Popular self-report measures (e.g., LASSI, Weinstein et al. 1987; MSLQ, Pintrich et al. 1993; SBI, Bliss and Mueller 1993) have tended to measure SRL as a disposition, prompting responders to aggregate responses across time. This provides limited information to understand how learners make strategic decisions and small-grained adaptations over time. Assessing SRL as an event means measuring SRL as it occurred in a particular study episode, rather than learners' perceptions of what they generally do (Patrick and Middleton 2002).

Second, regulation is sensitive to context. Learners adjust what they do and how they study depending upon task, self, and context conditions (Winne and Hadwin 1998). Hadwin, Winne, Stockley, Nesbit, and Woszczyna (2001) found learners adjusted tactics, resources, and goals in each of three separate learning tasks. Measures of SRL need to be sensitive to conditions that influence learners' regulatory decisions, yet many self-report inventories aggregate responses across different types of tasks (Patrick and Middleton 2002). For instance, contextual frames for LASSI and MSLQ include varied task contexts, such as completing course readings, studying for exams, and writing term papers.

Third, learners use more than strategy knowledge and application to productively self-regulate. The specific tactics or strategies learners engage vary from task to task and goal to goal. However, successful learners engage in regulatory processes regardless of the task or goal. Existing self-report questionnaires have focused mainly on strategies learners use, such as highlighting, elaborating or time use (e.g., Yang and Bliss 2014). Rather, the focus for measuring SRL needs to be on the regulatory processes learners engage, such as attempts to unpack task descriptions and monitor learning.

From our perspective, assessing SRL requires measures that are sensitive to time, task, and metacognitive processes. In addition, researching SRL needs to be done in authentic learning situations that have meaning for learners and present real challenges, whether cognitive, metacognitive, motivational, or behavioral. Knowing how students adjust studying when they have just failed an economics midterm or how they tackle an essay when they are struggling with procrastination reveals active regulation processes that arise in response to student-centered challenges and authentic problems in their own learning milieu. Therefore, we posit that

understanding and providing timely SRL support requires more systematic assessment of students' challenges, experiences, and perceptions in authentic learning situations.

While several self-report measures exist and are used extensively in the literature, more recent research has shifted to use of observation measures using observation protocols or computer-generated traces of SRL that track learners' actions in online material (Boekaerts and Corno 2005; Hadwin et al. 2004). Trace data include logs of keystrokes and clicks, tracking when learners click back to re-read a section, add notes or highlights, or check grades on a quiz, for instance. This requires researchers to make inferences about learners' intentions and decision making processes that guide learners' actions. The shift to objective observation measures has been spawned in part by findings that reveal the inaccuracy, or poor calibration, of student self-reports of learning (Hadwin et al. 2007). Winne and Jamieson-Noel (2002) found that students overestimated their use of study tactics when compared to traces of their actual tactic use. Furthermore, Winne and others (Winne 2010; Winne and Perry 2000; Winne et al. 2011) argue self-reports are limited simply because they depend on human memory. Learners base responses on (a) inaccurate recall of SRL products and processes, (b) an incomplete and biased sample of experiences, (c) a variety of contexts, and (d) strategies they know or believe to be effective rather than ones they actually engage (Winne et al. 2011). From this perspective, relying on learners' self-reports provides a skewed view of SRL on which to base and modify theories and interventions, and a shift towards observation-based measures of SRL is warranted.

However, consistent with Butler (2002), we argue self-reports provide important information for examining and interpreting SRL even when the reports are inaccurate or skewed. Learners' perceptions are central when the object of inquiry is self-regulated learning. Self-regulation refers to an individual's capacity to respond adaptively during learning; learners use their own monitoring judgments as a basis for control and regulation whether those judgments are accurate (Nelson 1996; Winne and Hadwin 1998; Winne et al. 2011). Learners are not always accurate in their judgments of learning (Nelson and Dunlosky 1991). Often they base studying decisions on how readily they can recall information, failing to take into account critical information such as delays between studying and testing that influence this evaluation (Bjork et al. 2013). However, understanding self-regulated learning means understanding learners' perceptions of the ways they interpret and respond to tasks, set goals, monitor and adapt learning in the context of those inaccurate evaluations.

In addition, a recent focus of SRL research has been on understanding SRL as an event. As a result, many self-report measures have been criticized for emphasizing SRL as a disposition under the assumption that self-report data are always dispositional in nature, requiring respondents to aggregate data across time and context. However, several innovative self-report approaches have been successfully employed to research SRL beyond its dispositional characteristics. These include diaries (Schmitz et al. 2011), microanalysis (Cleary 2011), and think aloud protocols (Greene et al. 2011). Each of these methods focuses on one specific event and thus has the ability to capture evolutions in learners' perceptions both during and across study sessions. These event-focused self-report approaches provide a much-needed qualitative lens for understanding how learners regulate (Butler 2002; Middleton and Paris 2002; Perry 2002). However, research has rarely combined data from multiple self-report instruments to examine patterns in students' perceptions and actions as regulatory responses to unfolding learning situations.

The purpose of this study was to explore the use of two forms of self-report data to understand SRL as it unfolds over time and context. We introduce the Regulation of Learning

Questionnaire as a questionnaire designed to be sensitive to time, context, and metacognitive processes. Combining this with Weekly Reflection diary data, we examine three interrelated research questions: (1) What components of SRL are captured by the Regulation of Learning Questionnaire? (2) What quantitative patterns of regulatory engagement emerge across one semester during which learners were enrolled in a course to improve SRL? and (3) What patterns emerge when quantitative and qualitative self-report data are combined?

### Method

#### Participants

Participants were 263 students from a mid-sized, non-urban Canadian university. Students were recruited from a first year, graded undergraduate course across three semesters. Participants' mean age was 19.5 years (57% female). Participants came from a range of faculties and disciplines. For 27% of participants, this was their first semester enrolled in post-secondary education.

#### Educational Context

Data were collected in a 12-week academic course called *Learning Strategies for University Success* about SRL processes and strategies, taught by members of our research team. Students attended a weekly lecture and corresponding lab component for a total of three hours of instruction a week. The lecture taught about the four-phase cycle of SRL (Winne and Hadwin 1998), the facets of SRL (cognition, behaviour, motivation/affect) and cognitive and behavioural strategies for becoming a productive self-regulated learner. The lab engaged learners in guided activities involving the application of regulatory strategies to regular academic work for courses outside *Learning Strategies*. As such, students were required to be concurrently registered in at least one other course. Of note, participants were strategically sampled from a course where students were expected to demonstrate changes in their SRL over time in order maximize variance in responses across participants and within participants over time. In other words, this research intentionally strived to test instruments that would be sensitive to event-based changes over time as well as student-based variability in SRL.

#### Measures

**Regulation of Learning Questionnaire.** The Regulation of Learning Questionnaire (RLQ; Hadwin 2009) is based on Winne and Hadwin's (1998) model of SRL. It assessed participants' perceptions of actions and strategies specific to key processes and phases associated with SRL: task understanding, goal setting and planning, monitoring, evaluating, and adapting. Rather than reporting on what they do generally, learners were instructed to think about a recent, particular study session for an exam and to respond based on that particular study session. In order to be used in other task contexts (e.g., writing a paper, reading for class, note-taking during a lecture), specific items may need to be modified.

Students' instructions were, "Think of a recent study session you did for an upcoming test or exam. When you answer the following questions think about that specific study session." Students focused on exam preparation and provided the name of the course for which they had been studying. Learners responded to items on a 7-point Likert response scale anchored at 1 *not at all true of me* and 7 *very true of me*. This scale is consistent with those used in other contemporary measures of studying (e.g., MSLQ).

The original RLQ comprised of 49 items targeting 5 a priori subscales: (a) Task Understanding (11 items; B1-B11; e.g., figured out why I am being asked to know this stuff), (b) Goal Setting and Planning (9 items; B12-B20; e.g., set goals that would be useful for checking on my own progress as I studied), (c) Monitoring (9 items; A1-A9; e.g., asked myself if I was

remembering the material), (d) Evaluating (10 items; A10-A19; e.g., appraised or estimated my progress), and (e) Regulating (10 items; A20-A29; e.g., switched to a different strategy or studying process).

**Weekly Reflections.** Weekly Reflections were composed of two separate sections focused on (a) *reflecting* on last week and (b) *planning* for this week (see Appendix A). The cycle began with a *planning* section in the first lab where the focus was to set a goal for one study session in the following week. In week 2, students started with the *reflecting* section and considered their goal attainment and challenges in meeting their goal followed by completing another *planning* section for the following week. The cycle continued over 12 weeks with each student reflecting on the previous week's goal accomplishment and planning for the upcoming week. Though there were minor changes in the specific wording of items across the semesters, the items were consistent in their focus and intent with respect to target regulatory processes. Weekly Reflection diaries were anchored in participants' authentic learning tasks in their other course work that varied week to week.

### **Procedure**

The institution's Human Research Ethics Board approved all procedures. Students consented to participate in research. Participants completed the RLQ online as a lab activity once during the first three weeks of the semester (Time 1;  $n = 244$ ) and again in the last two weeks of the semester (Time 2;  $n = 221$ ). Completion of the RLQ was required for a participation mark, but responses were not graded. Students were given immediate feedback in the form of a profile of a priori subscale scores and were required to use those scores to reflect on their own studying strengths and weaknesses. Participants completed the Weekly Reflections at the beginning of each lab. Completion of the Weekly Reflections was required for a participation mark, but the responses were not evaluated.

### **Analysis and Findings**

#### **Research Question 1: What is the Factor Structure of the RLQ?**

**Analysis.** Normally, confirmatory factor analysis (CFA) is used to confirm a priori subscale structure. However, CFA results in a previous study (McCardle et al. 2012) indicated poor model fit for each subscale, with the exception of Goals and Planning. Thus for this study, a more exploratory approach was chosen to identify a set of latent constructs with exploratory factor analysis (EFA). EFA was conducted in MPlus 6.12 (Muthén and Muthén 2010) using maximum likelihood estimation. Promax rotation, an oblique rotation, was used as it allows factors to correlate. This approach is consistent with theory positing that SRL phases are related (Winne and Hadwin 1998) and expected to correlate. Time 1 and Time 2 data were analyzed in separate models. Considering participants were in a course to improve SRL, we expected there would be some differences in factor structure at these two data collection points. We were interested in a factor structure that would allow researchers to capture changes in SRL across time. Goodness of fit was assessed using the following indices and their suggested values for good model fit:  $p$ -value for  $\chi^2$  statistic ( $ns$ ; Kline, 2010), standardized root mean square residual ( $.00 \leq SRMR \leq .05$ ; Byrne, 2001), and root mean square error of approximation ( $.00 \leq RMSEA \leq .05$ ; Kline, 2010).

As Step 1, separate EFAs with 49 items were run for data at Time 1 and Time 2 with 1-factor through 7-factor models. Following a priori subscales, it was expected 5 factors would best account for the data. At this point, items that loaded on two factors, had low factor loadings, or loaded on different factors at different times were removed from analysis; items that consistently loaded on a factor together were retained. For Step 2, separate EFAs with 4 and 5

factors for Time 1 and 2 were run with the remaining items. These data were examined for items that loaded on two factors, had low factor loadings, or loaded on different factors at different times. Final factors were created based on consistent grouping of items at Time 1 and Time 2 and similar grouping of items in the 4- and 5-factor solutions.

Finally, because students were learning about SRL and we expected changes in SRL across time, it is important to consider factorial invariance. Factorial invariance examines whether measures are equal across time or samples (Meredith 1993). Low factorial invariance implies differences between samples or across time may be due to changes in the factor weightings of the subscales rather than in the construct itself. Models of factorial invariance between Time 1 and Time 2 were run separately for each factor. Three levels of factorial invariance were examined: (a) the configural baseline provides a model for comparison where the same items are constrained to load on a factor at Time 1 and Time 2 but the regression-loadings are free to vary, (b) the model of weak factorial invariance constrains item factor loadings to be equal at Time 1 and Time 2, and (c) the model of strong factorial invariance constrains factor loadings and item intercepts to be equal. Model fit was assessed using the same indices as the EFA, with the addition of comparative fit index ( $CFI \geq .90$ ; Kline 2010), and the Tucker-Lewis index ( $TLI \geq .95$ ; Byrne 2001).

**Findings.** In Step 1, models with 6 and 7 factors did not converge for Time 1 data. Models with 4 and 5 factors had the best, though very poor model fit (see Table 1). At Time 2, 6- and 7-factor models did converge and model fit was improved over 4- and 5-factor models. However, the additional factors in these models did not add anything substantive to the 4- and 5-factor models from Times 1 and 2 and included factors that were difficult to interpret. Thus, 4- and 5-factor solutions at Time 1 and 2 were examined more closely (see Appendix B). Twelve items were removed from the analysis at this step: B5, B7, B10, B11, B14, B18, B20, A14, A15, A19, A26, A27 (see Appendix C).

Table 1

*Step 1 EFA Model Fit*

Fit indices	1-factor	2-factor	3-factor	4-factor	5-factor	6-factor	7-factor
Time 1							
$\chi^2$	12138.2*	11398.3*	11048.5*	10625.4*	10345.8*	<sup>a</sup>	<sup>a</sup>
<i>df</i>	1175	1126	1078	1031	985		
RMSEA	0.196	0.193	0.195	0.195	0.197		
RMSR	0.105	0.080	0.073	0.066	0.058		
Time 2							
$\chi^2$	3370.7*	2668.4*	2339.4*	2053.5*	1839.4*	1655.9*	1507.1*
<i>df</i>	1127	1079	1032	986	941	897	854
RMSEA	0.095	0.082	0.076	0.070	0.066	0.062	0.059
RMSR	0.107	0.077	0.066	0.058	0.053	0.047	0.043

*Note.* \* indicates  $p < .05$ . <sup>a</sup> Models did not converge.

In Step 2, separate EFAs were run with the remaining 37 items with Time 1 and Time 2 data. Acceptable model fit was obtained at Time 1 for the 4-factor solution ( $\chi^2(524) = 1215.7, p = <.001, RMSEA = .074, RMSR = .049$ ) and 5-factor solution ( $\chi^2(491) = 1059.7, p = <.001, RMSEA = .069, RMSR = .046$ ). At Time 2, acceptable model fit was found for the 4-factor solution ( $\chi^2(524) = 1098.7, p = <.001, RMSEA = .070, RMSR = .052$ ) and the 5-factor solution ( $\chi^2(491) = 926.2, p = <.001, RMSEA = .063, RMSR = .045$ ). Due to acceptable fit of both 4- and 5-factor solutions, we examined both solutions at both times to create the final factors (see Appendix D).

At this point, no items were removed due to loading on two factors, or having low factor loadings. There were some items loadings on different factors in different models, and these items were dealt with individually (see Appendix C): (a) B8 and B9 did not consistently load with the other Task Understanding items in the 5-factor solution but did in the 4-factor solution, and were retained with this factor as they were theoretically related; (b) B19 loaded with Goal Setting items in the 4-factor solutions but not in the 5-factor solutions and was removed as it is theoretically more consistent with planning while the remaining items in the Goal Setting factor were more focused on goals; (c) A1 loaded either with the Monitoring or Evaluating items but had stronger loadings with Evaluating and was retained with these items; (d) A20 cross-loaded with Evaluating items at Time 1 but not at Time 2 and was retained with the Adapting items as it was theoretically related; and (e) A29 had loaded with Task Understanding items in the first EFA but did not demonstrate loadings above .3 on any factor in the second EFA and was removed.

Five factors were created based on consistent grouping of items across Time 1 and Time 2 and similar grouping of items in the 4- and 5-factor solutions. Items in both the Task Understanding and Adapting factors were clearly and consistently grouped together across the solutions examined. The Goal Setting items and Evaluating items tended to group together at Time 1, but the Goal Setting items were a separate factor at Time 2 in both 4- and 5-factor solutions. As Goal Setting and Evaluating are theoretically distinct processes (Winne and Hadwin 1998), Goal Setting was considered a separate factor. Similarly, Monitoring and Evaluating items were not clearly separated in the 4-factor solutions but were in the 5-factor solutions and are theoretically separate processes and were retained as two factors.

The final five factors were labeled (a) Task Understanding, (b) Goal Setting, (c) Monitoring, (d) Evaluating, and (e) Adapting. Table 2 presents (a) items, (b) item and subscale means and standard deviations, and (c) Cronbach's alphas for the five factors. Cronbach's alpha, a measure of reliability, was above acceptable level of .7 (Nunnally, 1978) for all factors at Time 1 and Time 2.

Model fit indices for each of the factorial invariance models for the five factors are found in Table 3, including differences in  $\chi^2$  and degrees of freedom. Change in  $\chi^2$  statistics for Task Understanding and Adapting factors indicated model fit did not become significantly worse in the strong model, suggesting acceptance of strong factorial invariance. For Goal Setting, Monitoring, and Evaluating, there were significant changes in  $\chi^2$  statistics, indicating poorer fit of the more stringent model, but inspection of RMSEA and other relative fit statistics did not show major changes, suggesting acceptance of strong factorial invariance. Overall, model fit indices were weak. This finding is of particular interest because theory predicts that students with more self-regulated learning experience (Time 2) should develop more stable and purposeful approaches to studying in contrast with inexperienced regulators (Time 1) who may adopt random patterns of studying, engaging (or reporting) particular actions out of habit rather than strategic intent. For this reason we continued with further analysis, recognizing that, in the

Table 2

*RLQ Items and Descriptives by Factor*

No	Item	Scale <sup>a</sup>	Time 1			Time 2		
			<i>M</i>	<i>sd</i>	$\alpha$	<i>M</i>	<i>sd</i>	$\alpha$
Task Understanding								
B1	Figured out what I was being asked to know	TU	5.37	1.44		5.96	1.13	
B2	Figured out why I am being asked to know this stuff	TU	4.42	1.72		5.12	1.49	
B3	Identified what I need to learn	TU	5.66	1.27		6.14	0.96	
B4	Made sure I understood terminology used in task instructions	TU	5.48	1.28		5.78	1.14	
B6	Figured out what course theories or big ideas I should know for this study session	TU	5.58	1.37		6.05	1.08	
B8	Figured out why studying this is important in this course or discipline	TU	4.86	1.66		5.09	1.52	
B9	Figured out what documents/resources I should use for my studying (files, notes and readings)	TU	5.85	1.23		6.05	1.19	
	Scale (7 items)		5.32	0.97	.72	5.06	1.15	.79
Goal Setting								
B12	Set goals for my work	GP	4.63	1.67		5.44	1.33	
B13	Set goals that identify specific concepts, ideas, or terms I need to know	GP	4.68	1.67		5.42	1.39	
B15	Set goals that would be useful for checking on my own progress as I studied	GP	3.96	1.75		4.97	1.42	
B16	Set goals that can be completed within a 1-2 hour time block	GP	4.23	1.82		5.14	1.64	
B17	Created a study timeline	GP	3.37	2.00		4.35	1.95	
	Scale (5 items)		4.17	1.23	.80	5.74	.082	.79
Monitoring								
A2	Asked myself if I knew what was important	MON	5.20	1.59		5.76	1.26	
A3	Asked myself if I was understanding what I needed to know	MON	5.35	1.55		5.80	1.24	
A4	Asked myself if I was remembering the material	MON	5.36	1.58		5.81	1.21	
A5	Asked myself if I was understanding the material	MON	4.31	1.81		5.07	1.47	
	Scale (4 items)		5.23	1.41	.90	5.78	1.04	.86

*Note.* TU = task understanding; GP = goal setting and planning; MON = monitoring; EV = evaluating; AD = adapting.

<sup>a</sup> A priori subscale

Table 2 Continued

*RLQ Items and Descriptives by Factor*

No	Item	Scale <sup>a</sup>	Time 1			Time 2		
			<i>M</i>	<i>sd</i>	$\alpha$	<i>M</i>	<i>sd</i>	$\alpha$
Evaluating								
A1	Reflected on the way I studied	MON	5.00	1.72		5.74	1.27	
A6	Checked to see if my strategy (approach) was working	MON	4.60	1.71		5.36	1.33	
A7	Checked to see if I was making progress toward my goals	MON	4.39	1.80		5.40	1.40	
A8	Checked to see how I was doing with respect to the time I had allotted	MON	4.48	1.85		5.36	1.46	
A9	Checked to see if the goals I set for my studying were appropriate for the kind of test/exam I would be having	MON	4.61	1.68		5.40	1.31	
A10	Appraised my current understanding of the material	EV	3.57	1.84		4.51	1.76	
A11	Looked at feedback about the way I was studying	EV	4.36	1.62		5.14	1.42	
A12	Appraised or estimated my progress	EV	4.70	1.62		5.26	1.37	
A13	Appraised or estimated my memory for the information	EV	5.29	1.74		5.08	1.70	
A16	Made a judgment about the usefulness or value of something I was studying	EV	4.23	1.70		4.80	1.64	
A17	Appraised the effectiveness of the strategies I used	EV	4.09	1.71		4.85	1.59	
	Scale (11 items)		4.36	1.20	.89	5.12	0.97	.86
Adapting								
A20	Changed or revised my understanding of what I was trying to do (the task itself)	AD	3.89	1.77		4.29	1.78	
A21	Changed my studying goal (what I was aiming for)	AD	3.42	1.87		3.87	1.85	
A22	Changed my plans for how to study	AD	3.57	1.96		3.83	1.85	
A23	Switched to a different strategy or studying process	AD	3.34	1.96		3.68	1.93	
A24	Changed the way I was feeling about the studying	AD	3.91	1.88		4.31	1.73	
A25	Changed the level of effort I was engaging in the work	AD	4.38	1.75		4.46	1.77	
A28	Changed my beliefs about how well I would do on this test	AD	4.67	1.81		4.96	1.61	
	Scale (7 items)		5.32	1.23	.83	5.74	.082	.83

*Note.* TU = task understanding; GP = goal setting and planning; MON = monitoring; EV = evaluating; AD = adapting.

<sup>a</sup> A priori subscale.

Table 3

*Model Fit Indices for Factorial Invariance Models*

Model	$\chi^2$	df	$\chi^2$ diff	df diff	RMSEA	CFI	TLI	RMSR
<b>Task Understanding</b>								
Configural	159.8*	69			.079	.898	.866	.059
Weak	172.0*	75	12.3	6	.078	.891	.868	.071
Strong	178.6*	80	6.6	5	.076	.890	.874	.072
<b>Goal Setting</b>								
Configural	45.5*	29			.052	.973	.958	.039
Weak	56.1*	33	10.7*	4	.057	.962	.948	.057
Strong	69.5*	37	13.3*	4	.064	.947	.935	.058
<b>Monitoring</b>								
Configural	66.0*	15			.127	.948	.902	.053
Weak	76.0*	18	10.0*	3	.123	.940	.907	.079
Strong	83.2*	21	7.1*	3	.118	.936	.915	.075
<b>Evaluating</b>								
Configural	564.2*	239			.080	.856	.833	.055
Weak	579.9*	250	15.7	11	.079	.854	.838	.063
Strong	611.2*	261	31.3*	11	.080	.836	.836	.069
<b>Adapting</b>								
Configural	161.5*	69			.080	.915	.888	.053
Weak	166.1*	75	4.6	6	.076	.916	.898	.056
Strong	169.9*	80	3.8	5	.073	.917	.906	.058

Note. \* indicates  $p < .05$

absence of factorial invariance, some caution should be exercised in interpreting results<sup>1</sup>. This is considered at length in the discussion.

### **Research Question 2: What Quantitative Patterns of Regulatory Engagement Emerge Across One Semester?**

**Analysis.** Latent class analysis (LCA) serves to identify discrete latent variables (class) based on participants' profile of responses to a group of items. Using LCA allowed us to explore patterns of change in RLQ across Time 1 and 2 data collection points. Participants who had complete data at both time points ( $n = 212$ ) were included in analysis. Means for each subscale (as defined by the EFA) were created for Time 1 and Time 2 and a difference score (Time 1

<sup>1</sup> Additional CFA and invariance models were run including only the items whose factor loadings did not change by more than .049 from Time 1 to Time 2 (based on original strong FI models). Thus, in these models items from TU (B4, B8, B9), Goal setting (B12, B15), Monitoring (A4, A5), and Evaluating (A10, A11, A12, A13, A17, A18) were not included. CFA of the RLQ as a whole had weak model fit and strong factorial invariance was considered acceptable for the modified subscales (FI models for Monitoring were unidentified with only two remaining items). Factorial invariance models had drastic improvement in fit relative to the models that included our final set of items. See discussion for further consideration of these items.

subtracted from Time 2) was calculated, incorporating a time component to the analysis. This resulted in 10 variables: means on the five EFA-defined factors at Time 1 and a difference score for each factor to account for change to Time 2. Though the use of gain scores has been debated in the literature, they are appropriate for educational research because they address the intra-individual change indicating learning has taken place (e.g., Williams and D. Zimmerman 1996), which is the focus of the current study.

LCA models were fitted in Mplus 6.12 (Muthén and Muthén 2010) to these 10 variables. Six LCA models were run with 2, 3, 4, 5, 6, and 7 classes. Model choice was based on (a) goodness-of-fit indices and (b) interpretability of results. Goodness-of-fit indices considered were the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Lo-Mendell-Rubin Adjusted Loglikelihood Ratio Test (LMR), and the Bootstrap Likelihood Ratio Test (BLRT). As per Nyland, Asparouhov, and Muthen (2007), BIC was given most weight when deciding on best model fit.

**Findings.** A 4-class model was chosen amongst multiple options because it was statistically viable and theoretically interpretable. Table 4 contains fit indices and entropy values for 2- through 7-class models. The 5-class model had the lowest BIC, but this was only slightly improved over the 4-class model and the  $p$  value for the adjusted LMR was above .3. Both the 3- and 4-class models were significant at  $p < .05$  after running the BLRT and both models were interpretable. The 4-class model was chosen because it had a lower BIC and higher entropy value.

Table 4

*Model Fit Indices for 2-, 3-, 4-, and 5-Class Models*

	2-Class Model	3-Class Model	4-Class Model	5-Class Model	6-Class Model	7-Class Model
Estimated parameters	31	42	53	64	75	86
Loglikelihood	-3299.5	-3209.8	-3158.0	-3128.1	-3015.3	-3078.5
AIC	6660.9	6503.7	6421.9	6384.1	6360.5	6329.1
BIC	6666.7	6644.6	6599.8	6599.0	6612.3	6617.7
LMR <sup>a</sup>	512.1	176.2	102.0	58.8	44.9	52.2
$p$	0.014	0.061	0.13	0.33	0.77	0.38
Entropy	0.86	0.87	0.88	0.85	0.85	0.85
BLRT loglikelihood difference		179.232	103.841			
$\Delta$ parameters		11	11			
$p$		<.001	<.001			

a. Lo-Mendell-Rubin Adjusted LRT Test

Table 5

*Subscale Means (SD) and Difference Scores (SD) by Four Classes*

Subscale	Emergent Regulators ( <i>n</i> = 21)		Moderate Regulators ( <i>n</i> = 83)		High Regulators with Emergent Adapting ( <i>n</i> = 40)		High Regulators ( <i>n</i> = 68)	
	Time 1	Diff	Time 1	Diff	Time 1	Diff	Time 1	Diff
Task Understanding	4.12 (1.08)	1.88 (1.38)	4.92 (.76)	0.64 (.97)	6.13 (.66)	-0.29 (0.93)	5.75 (.65)	0.12 (1.31)
Goals	2.67 (.75)	2.78 (1.03)	3.54 (1.01)	1.51 (1.30)	4.90 (.90)	0.00 (1.29)	5.04 (.75)	0.10 (1.13)
Monitoring	3.16 (1.18)	2.87 (1.21)	4.84 (.92)	0.846 (1.16)	6.46 (.67)	-0.41 (1.08)	5.84 (1.02)	-0.15 (1.25)
Evaluating	2.61 (.83)	2.78 (.86)	3.82 (.81)	1.23 (.93)	5.11 (.81)	.275 (1.06)	5.26 (.74)	-0.30 (1.06)
Adapting	2.50 (.63)	1.82 (1.16)	3.83 (.85)	0.41 (1.31)	2.75 (.76)	1.29 (1.30)	5.22 (.92)	-1.03 (1.35)

*Note.* Diff = difference score, calculated by subtracting Time 1 scores from Time 2 scores. Positive differences reflect higher scores at Time 2.

Table 5 lists means and standard deviations of the five RLQ factors and the difference scores for each of the four classes. We labeled the four classes based on observed patterns. (1) *Emergent regulators* ( $n = 21$ ) were participants with relatively low RLQ scores at Time 1 with large increases at Time 2. (2) *Moderate regulators* ( $n = 83$ ) demonstrated relatively moderate scores at Time 1 with small to moderate increases. (3) *High regulators with emergent adapting* ( $n = 40$ ) had relatively high scores at Time 1 with little change at Time 2, with the exception of the Adapting subscale that started out low and improved at Time 2. (4) *High regulators* ( $n = 68$ ) were participants with relatively high scores at Time 1 and little change at Time 2.

### **Research Question 3: What Patterns Emerge When We Combine Quantitative and Qualitative Self-Report Data?**

**Analysis.** Five participants from each of the four classes were selected for in-depth qualitative analysis. Participants were randomly selected from those in each class whose probability of being in another class was low (less than 1%). There was at least one participant from each semester in each class, with the exception of class 3 *high regulators with emergent adapting* that had no participants from Spring 2010 semester. Data for participants were combined across the four classes for analysis so researchers were blind to the latent class of the participant. We created individual SRL profiles for each participant in three steps.

First, two researchers read the collection of Weekly Reflections to become familiar with the data and recorded overall impressions about each participant's SRL processes. Second, we coded quality of four SRL categories: task understanding, goal setting, monitoring/evaluating, and adapting. Monitoring and evaluating were combined because they were difficult to distinguish in the qualitative data. Quality codes were based on all Weekly Reflections items, though some codes focused more on data in particular items (e.g., goals codes were based mainly on the goals participants set). Quality was rated as low, moderate, high, improving, decreasing, or not enough information. Each of the two researchers closely examined Weekly Reflection diary entries for each participant over 11 weeks and independently rated each participant on each of the SRL categories. We identified a fifth category after our first time through the data that was labeled "metacognitive awareness" and this was coded in our second round of data coding. Ratings for all categories were discussed and discrepancies were resolved through discussion.

Third, we augmented quality ratings with case notes that briefly described each participant in terms of regulatory awareness or behavior. The resulting individual SRL profiles for each participant included quality ratings on five SRL categories (task understanding, goal setting, monitoring/evaluating, adapting, and metacognitive awareness) and a brief description of their SRL across the semester.

Finally, individual qualitative SRL profiles were grouped based on membership in RLQ latent classes, while being blinded to original four latent class labels or descriptors (see Appendix E). Each group of individual SRL qualitative profiles was examined to identify common themes and discrepancies in terms of SRL. This resulted in four qualitative group profiles or descriptions of cases. Individual and group profiles were presented to a panel of SRL research experts for discussion. The panel identified motivational aspects as a common theme in the individual and group profiles, so motivation was added as a sixth SRL category. The two original researchers then

completed a third round of coding for quality of motivation for each participant and added motivation to the descriptions of the four groups.

**Findings.** For each of the four groups, qualitative, Weekly Reflection-based group SRL profiles are described and then a comparison is made with the quantitative, RLQ-based profiles (see Table 6 for a summary).

Table 6

*Summary of RLQ and Weekly Reflection Profiles*

Latent Class	Quantitative Label (RLQ)	Qualitative Label (Weekly Reflection)
1	<i>Emergent regulators</i> Low scores at Time 1 with large improvements at Time 2	<i>Unengaged regulators</i> Demonstrated low engagement of SRL processes across the semester
2	<i>Moderate regulators</i> Moderate scores at Time 1 with small to moderate increases at Time 2	<i>Active regulators</i> Demonstrated intentional self-improvement attempts
3	<i>High regulators with emergent adapting</i> High scores at Time 1 and 2 except for Adapting that started out low and improved	<i>Struggling regulators</i> Demonstrated unsuccessful attempts to adapt learning
4	<i>High regulators</i> High scores at Time 1 and 2	<i>Emergent regulators</i> Demonstrated improvement in at least one facet of SRL

We labeled the first group as *unengaged regulators* because they evidenced low engagement of regulatory processes across the semester. Ratings for the SRL categories were generally low with a few exceptions of improving in terms of metacognitive awareness, monitoring and evaluating, or goals. Improvements for these participants were still small. For example, one participant was rated as improving in goals due to some weeks having more specific standards and actions but this was not consistent from week to week. These students had fairly low metacognitive awareness in that although they described some difficulties, they did not evidence intent to address these challenges. One participant was an exception to these patterns. She had generally moderate levels of regulatory engagement but seemed to have unsuccessful attempts at regulating as she described continually high stress levels throughout the semester with these being potentially debilitating at the end. Her low GPA from that semester (1.8/9) suggests she was not successful in managing her stress.

Compared with the qualitative Weekly Reflection label of *unengaged regulators*, this group of participants was labeled as *emergent regulators* based on their quantitative

RLQ profiles. This group had low RLQ scores at the beginning of the semester with relatively large increases at the end of the semester. In contrast to their RLQ scores, the Weekly Reflections suggested that these students were not actively taking charge of their own learning. This group was interesting because quantitative and qualitative profiles of these learners demonstrated little overlap and pointed to drastically different pictures of what occurred over the semester. There may be several explanations for this. First, it might seem as though this group of students learned in *Learning Strategies* how they should answer the RLQ but struggled to apply that knowledge to their own learning. It is possible these participants were responding to the quantitative measure in ways they perceived to be socially desirable (Fisher 1993). Second, it is also a possibility that these participants had cognitively adopted the course ideas and answered the RLQ based on how they thought they were engaging, but struggled to implement the strategies. Finally, it may be they were able to implement these regulatory actions in studying for their exams, but not in response to other challenges they saw in their academic learning.

We labeled the second group as *active regulators* because participants were characterized by intentional self-improvement. They had good metacognitive awareness evidenced by their description of their struggles. They demonstrated monitoring and evaluating as well as clear, deliberate attempts to make changes to their learning throughout the semester. Two participants had low task understanding, but evidenced awareness of this problem. Overall, these seemed to be students who were active and deliberate in experimenting with and improving their learning. Again, one participant was an exception to these patterns: an engineering student who was taking a drastically reduced course load (*Learning Strategies* plus one other course) and found he did not experience many challenges throughout the semester and likely had few opportunities to regulate.

Compared with the qualitative Weekly Reflection label of *active regulators*, this group of participants was labeled as *moderate regulators* based on their quantitative RLQ profiles. They had relatively moderate RLQ scores with moderate improvements to Time 2. This quantitative profile was supported by the qualitative profile of active regulators that were deliberate in their learning. This group of learners evidenced engagement of regulatory processes and attempts to adapt and improve their learning across the semester in their Weekly Reflections that was mirrored in their RLQ scores; this was a group with well-calibrated self-reports.

We labeled the third group as *struggling regulators* because participants in this group struggled to adapt to challenges. This group had a range of ratings in all phases of SRL and in metacognitive awareness. However, a common theme was that each of these students was aware of particular academic issues or problems encountered during studying, and reflected on difficulties in successfully addressing those problems. For instance, one student was rated as high on adapting because he attempted to deal with the same challenge in a different way each week despite never really succeeding. Thus, he was making adaptations but these were not necessarily successful. Participants in this group tended to report similar challenges week to week and all participants in this group had goals that lacked specific standards upon which they could monitor and evaluate progress. Generally, the focus of regulation was around surface characteristics such as time, grades, and environment, rather than a focus on learning and active engagement

with course content. There was one exception in this group: a student who often reported having no challenge in meeting his goal and thus perceived he had little reason to adapt.

Compared with the qualitative Weekly Reflection label of *struggling regulators*, this group was labeled as *high regulators with emergent adapting* based on their quantitative RLQ profiles. They had high RLQ scores at both Times 1 and 2 with the exception of the Adapting subscale that improved across time. Weekly Reflection data supports the increased engagement of adapting processes across the semester as this group evidenced consistent, yet unsuccessful or surface attempts at adaptation. However, high scores in the other RLQ processes were not always reflected qualitatively. The combination of this data revealed a group of active, but inefficient learners.

We labeled the final group as *emergent regulators* because students in this group demonstrated consistent improvement in some aspect of SRL. This group had a range of ratings in all phases of SRL and in metacognitive awareness but shared a common theme of improving and adapting. Four participants demonstrated improvement in setting task-focused academic goals while the fifth participant perceived that his goals were improving and helpful. Participants evidenced attempts to monitor/evaluate and adapt though these tended to focus on organization, time, and motivation rather than on learning and course content. Metacognitive awareness ranged from low to high with students seeming to have some awareness of struggles and strengths. The student with high metacognitive awareness was a qualitative anomaly in this group – she demonstrated high levels of SRL across all phases, except for goals that improved over time. She was a very proactive student who was continually taking steps to ensure she understood tasks. However, she had a fairly low GPA that semester (3/9).

Compared with the qualitative Weekly Reflection label of *emergent regulators*, this group of participants was labeled as *high regulators* based on their quantitative RLQ profiles. They had relatively high RLQ scores at both the beginning and end of the semester. Weekly Reflection data produced a slightly different picture of learners with emerging regulation. These learners demonstrated improvement in their engagement of regulatory processes that was not reflected quantitatively. It is possible these learners shifted in how they interpreted RLQ questions or were simply more aware of the extent to which they were engaging regulatory processes, that is, they became better at discerning evidence of their own regulation. Thus, it appeared that as their SRL engagement emerged, so did the calibration of their self-reports.

**Summary of quantitative/qualitative profiles.** Table 7 summarizes the degree to which information from the two self-report data sources corresponded. The lowest overlap was seen between quantitative and qualitative self-reports for those with *inconsistent SRL*. By juxtaposing these data sources, we may have revealed a group of students who “feigned” SRL by using improved knowledge to answer RLQ questions to appear more self-regulating, but who were not evidencing regulation in their planning for and reflecting on weekly studying activities. Moderate levels of overlap were seen for the *actively inefficient SRL* and *emerging SRL* groups (see Table 7). Students in both these groups evidenced a high level of overlap in some but not all aspects of regulation. For example, the *emerging SRL* group had high RLQ scores at both times while demonstrating qualitative improvements over the semester suggesting the RLQ scores were more accurate at Time 2. It may be that this group answered the RLQ differently at Times 1 and 2, as they learned more about SRL and became more aware of their own

regulatory processes. Only one group, *calibrated SRL*, demonstrated high overlap between the RLQ and Weekly Reflection profiles. RLQ scores for the *calibrated SRL* group were moderate with small to moderate increases across the semester and Weekly Reflections indicated active engagement in regulating. These students were engaged regulators from the beginning of the semester and continued to make attempts to apply what they were learning such as improvement in specificity of goals and metacognitive awareness of task perceptions. These changes were reflected in the moderate increases in RLQ scores, suggesting a high level of overlap between the qualitative and quantitative data sources.

Table 7

*Overview of Overlap between Quantitative and Qualitative Findings*

Overlap	Quantitative Label (RLQ)	Qualitative Label (Weekly Reflection)	What was revealed?
Low	Emergent regulators	Unengaged regulators	Inconsistent SRL <i>learners who gained knowledge about SRL to answer RLQ but did not evidence it weekly</i>
Moderate	High regulators with emergent adapting	Struggling regulators	Actively inefficient SRL <i>investing in adapting but finding little success</i>
Moderate	High regulators	Emergent regulators	Emerging SRL <i>change in SRL across semester not reflected in RLQ scores, potentially due to different interpretation of items or awareness of own learning</i>
High	Moderate regulators	Active regulators	Calibrated SRL <i>being honest with themselves about how they regulate</i>

### Discussion

We introduced a time- and context-specific questionnaire of SRL that focused on metacognitive processes (rather than cognitive tactics) with factor analysis resulting in five subscales: task understanding, goal setting, monitoring, evaluating, and adapting. Using means for these factors at two times, latent class analysis resulted in four patterns labeled emergent regulators, high regulators with emergent adapting, high regulators, and moderate regulators. Qualitative analysis was conducted on scripted, written diaries for a subsample of participants from each latent class. Based on qualitative analysis, latent class profiles were re-labeled, respectively, as unengaged regulators, struggling regulators, emergent regulators, and active regulators. The juxtaposition of quantitative and qualitative profiles revealed varied levels of overlap, despite both data sources being self-report. We highlight four facets of SRL measurement that we attempted to address in

this study, discussing both strengths and weaknesses. We suggest further lines of inquiry to continue development of assessments that can capture learners' perceptions of their SRL as it unfolds over time.

### **Information About Context**

Consistent with Winne et al. (2011), we concur that context cannot be ignored. Thus, in this study, all data focused on one study episode: either exam preparation (RLQ) or a participant-chosen weekly task required for an academic course (Weekly Reflections). In some cases those tasks changed week to week; in others, they were repeated across multiple weeks. For example, while RLQ items were focused on the task of studying for an exam, one student most often completed Weekly Reflections around chemistry lab reports. This can be considered a strength of this study in that this data captured learners' perceptions of regulation situated in specific, authentic academic learning contexts. Profiles based on these particular instances created opportunities to capture the diversity and sometimes inconsistency in regulation across tasks and contexts.

On the other hand, the fact that we were unable to systematically control the specific exam and tasks contexts students reported in each of the self-report measures introduced some complexities and potential limitations. The diversity of task contexts differed within students over time, across reporting instruments (RLQ or weekly diaries), and amongst students. While transfer of SRL across different types of tasks is often assumed in theory, very few empirical studies have examined transfer or even changes in SRL across contexts and tasks (cf., Alexander et al. 2011). Some research has suggested learners engage similar metacognitive processes across tasks in different domains (e.g., Veenman and Spaans 2005), while other research suggests even within a domain, learners adjust their approach based on task contexts (Hadwin et al. 2001). In this study, we combined instances of SRL across tasks to create profiles. Further research needs to systematically examine similarities and differences in learners' perceptions of their regulatory engagement across varied, specific task and context conditions in multiple domains.

### **Multiple Time Points**

Regulation in Winne and Hadwin's (1998) model implies strategic adaptation over time and tasks based on conditions of the particular situation. Thus, in order to understand how regulation unfolds, SRL cannot be measured as aggregated across time and tasks, nor can it be measured as a single learning event (Winne and Perry 2000). Rather, because SRL is sensitive to changes in context, measurement of SRL should span multiple, in-context learning sessions. A strength of the current study was that quantitative and qualitative profiles in this study drew on multiple time samples focused on a variety of tasks and academic challenges. Each data point was considered one "snapshot" in time that contributed to a general characterization of SRL engagement. For instance, a typical member of the *emerging SRL* group, evidenced attempts to better understand the task in one session by reading "further into questions asked of me to complete my chemistry lab report" and adaptations such as using additional resources and consulting "with a friend to compare and edit my report". Together, these self-reported actions contributed to the characterization that she was metacognitively aware of her own learning. Rather than asking learners to aggregate across time, instruments used in this study created opportunities to gather data in multiple, in-context learning sessions to create a characterization of learners' SRL across multiple tasks. Profiles of regulation

constructed in this manner have potential to reveal differing patterns between novice and experienced regulators.

A possible limitation of this study was that the RLQ was administered at only two points in time in this study in contrast to Weekly Reflection self-reports that were administered across twelve weeks. Therefore, quantitatively-derived profiles of regulation were based on much less frequent sampling of RLQ self-reports than qualitatively-derived profiles. Future research should create and contrast quantitative and qualitative profiles based on multiple samples of the same study sessions. While some researchers have been combining data sources in one laboratory session (e.g., Azevedo et al. 2010), this work needs to be extended to understand how learners build upon experiences to adaptively regulate from one session to another. Winne and Hadwin (2008) propose that this kind of large-scale adaptation is what makes SRL so powerful.

### **Changes in SRL**

A major contribution of the current study has been in the attempt to analyze and examine SRL profiles in ways that are sensitive to context. As a result, instruments used in this study required students to self-report on aspects of their own regulation at multiple time points and across varied tasks. Yet, in our research, we are also interested in capturing how these patterns across multiple tasks change over time. That is, do our measurements capture systematic changes in SRL competencies, such as learning and applying new strategies or beginning to systematically analyze tasks in ways they did not previously engage? By researching regulation in a *Learning Strategies* course, we strategically examined and contrasted self-reports of SRL as learners developed knowledge and awareness of strategic learning and self-regulation. The strength of situating this research in a course about SRL constructs and practices is that it created an opportunity to examine the emergence of SRL over time in a context where intra-individual change was both expected and prompted. We acknowledge that while we aimed to capture this change from novice to experienced regulator, this change may also have affected measurement in terms of how learners answer items, particularly on the RLQ. In order to account for these potential changes, the RLQ factor structure was constructed with the goal of finding the best model fit that could be utilized for both time samplings (beginning *and* end of the semester in the *Learning Strategies* course). Several items had a change in factor loading from Time 1 to Time 2 over .05. These items may be particularly sensitive to development of sophistication in SRL processes. For example, items B8 “Figured out why studying this is important in this course or discipline”, B15 “Set goals that would be useful for checking on my own progress as I studied”, A4 “Asked myself if I was understanding the material”, and A17 “Appraised the effectiveness of the strategies I used” all showed relatively large changes in factor loading. Theoretically, these are important actions for regulating learning and may particularly be items that distinguish between more and less sophisticated regulators or metacognitive actions that develop through interventions such as *Learning Strategies*. Though we retained these items in our analysis, further research is warranted examining these items, perhaps employing an item response theory approach. Items such as these may particularly point to salient aspects of regulation that develop over time or in response to intervention. Because we aimed to capture these types of changes, we retained these items, trying to find the best model fit at both times and we acknowledge this approach comes with strengths and weaknesses.

Whereas participants were considered naïve to SRL theory and concepts at Time 1, they may have been primed to answer questions at Time 2 in ways that reflected the theory and concepts taught in the course. If learners interpreted or responded to questions differently based on their new knowledge, this may have contributed to poor overall fit of factorial invariance models, which has important implications for reliably and validly capturing intra-individual changes in students' regulation. However, it is possible that changes in the factor structure from Time 1 to Time 2 reflect important changes in learners' patterns of SRL. Perhaps a characteristic of developing expertise in SRL is that learners settle into more consistent and intentional patterns of studying that fit a factor structure most similar to the theoretical model proposed by Winne and Hadwin (1998). In contrast, novice regulators may engage in fairly random studying actions that lead to weaker model fit relative to the a priori theory. Put simply, students who have not been exposed to SRL concepts and practices may not respond in similar ways to the RLQ due to weak regulatory knowledge and practice characterized by random efforts to invest in specific studying behaviors, rather than less frequent actions within factors themselves. Research exploring this possibility is warranted.

In addition, patterns in the qualitative data suggest there are different trajectories of growth and development of SRL; it is possible that different trajectories result in different patterns of factorial invariance. Our research did not examine patterns of factorial invariance across the groups of students with different qualitative profiles. Further research is needed to ascertain what changes in measurement (e.g., items, factors) take place as students develop SRL competencies at different rates and in different manners and how measurement can best capture these systematic changes in patterns of SRL.

Finally, it is also a possibility that a factor model is not the best approach for measuring regulation as a time- and context-specific event. As Winne (2010) alluded to, the field is still experimenting with measurement of SRL. Our findings suggest that further research is needed on the application of traditional statistical techniques to event-based measures of SRL that aim to capture changes in patterns over time.

### **Multiple Types of Data**

In this study, we sought to explore the combination of quantitative and qualitative self-report. There was dramatic variation across latent classes in the degree to which quantitative and qualitative self-report profiles corresponded; in other words, the two types of self-report data did not always align. These findings suggest multiple self-report measures may reveal differences in the ways students perceive and report their own studying actions. The type of item or response modality might have influenced how learners responded (Dunn et al. 2010; Koning et al. 2010) or how they make sense of their own regulation (Winne and Perry 2000). Self-report questionnaires with ratings may promote self-evaluative reporting, encouraging learners to present themselves positively rather than reporting on what they did. In our study, receiving a personalized report of subscale scores immediately after completed the RLQ might have exacerbated this. A strength of this study was the use of latent classes to examine differences in students' patterns of regulation according to quantitative and qualitative self-reports. Another interesting approach to examining this combination of data would be to group individual qualitative SRL profiles based on similarities and examine differences in membership based on quantitative and qualitative data. Research using this approach may reveal

further insights into influence of type of measure on how learners report and understand their SRL.

The focus on self-report might be considered a limitation in this study considering previous research demonstrated learners' self-reports are not always aligned with what they actually do (Hadwin et al. 2007; Winne and Jamieson-Noel 2002). The general explanation has been that students' beliefs about their studying differ from what they actually do. Findings from this study revealed that even multiple forms of self-report data provided rich and varied data about regulation in action. Since learners' inferences and understanding about their own actions theoretically become conditions that inform choices in future study sessions (Winne and Hadwin 1998), self-reports such as those used in this study cannot be ignored. Otherwise, there is a great risk of misinterpreting changes in student intent and actions as well as the conditions that drive them. Consistent with others (e.g., Azevedo et al. 2010; Winne 2010), we propose that combining these rich types of self-report measures with objective or trace-based measures of regulation is essential if future research is to examine (a) the ways learner intent and reflection contribute to regulatory adaptation in studying and (b) the intra-individual differences that are characteristic of emerging regulation.

Despite the challenges, the combination of multiple data sources has important practical implications: if we base interventions solely on one data source, interventions and responses may be poorly calibrated with target areas for SRL support (see Table 7). For example, based solely on the latent class analyses of quantitative self-reports, the group with *inconsistent SRL* demonstrated growth and might not be a priority for intervention at all. More detailed analysis of Weekly Reflections indicated this same group of students appeared to lack awareness of their own learning and did not engage in attempts to improve and adapt their learning, suggesting immediate need of regulatory support. Putting the two self-report profiles together provided a richer picture of regulatory knowledge and proficiency, and a better basis for designing appropriate interventions than either data source alone. Scaffolding regulation requires support to be individualized, to target specific aspects and phases of SRL, and to shift as learners' regulatory competencies develop (Azevedo and Hadwin 2005). Future research needs to examine how to draw on multiple data sources to create profiles that can be used to develop and implement appropriate scaffolding of SRL processes.

### **Concluding Thoughts**

This paper presents a novel way of capturing and analyzing SRL self-report that situates regulation in specific studying episodes (Winne and Perry 2000). SRL profiles based on multiple context-specific snapshots of regulation acknowledge the adaptation of SRL processes to specific conditions that vary across study episodes. Contrasting responses to a quantitative measure with qualitative diary entries revealed interesting differences across groups in terms of consistency between the two self-report measures. This raises some critical questions for the field about measurement of SRL and the importance of gathering data on learners' perspectives of their SRL. A challenge for the field is to continue to collect and examine self-report measures as a method for revealing how learners make sense of their own learning and regulation. Additionally, the emergence of motivation as an important factor in Weekly Reflections, serves as an important reminder that motivation is under-represented in the RLQ measure used for this

study. As noted by several researchers (e.g., Boekaerts 1995, 1996; Schunk 2003), motivation is critical to understanding learners' engagement of SRL processes.

This paper also makes some strides toward examining the emergence in SRL expertise as a set of events that build on one another over time. This study reflects an important shift in SRL theory that views regulation as strategic adaptation over time rather than static competency. Future research needs to examine the relationship between emerging expertise in SRL and academic performance as much of the research relating SRL to academic performance has been based on aggregate measures of SRL (e.g., Cleary and Chen 2009; Pintrich and De Groot 1990; Rotgans and Schmidt 2000). Understanding ways learners systematically adapt patterns of regulation is critical for further development of support and scaffolds for SRL.

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Appendix A  
Weekly Reflection Items by Semester

<i>Aim of Item</i>	Spring 2010	Fall 2010, Spring 2011
<i>Reflecting Section</i>		
Rating of learners' perception of goal attainment	How successful were you in achieving your goal from last week? On a scale from 1 to 10, I was... (1 = not very successful to 10 = very successful) <i>[open]</i>	How well did I attain my goal last week? <i>[forced choice: 1 did not attain at all, 2, 3 moderate attainment, 4, 5 fully attained it]</i>
Difficulty encountered in enacting the task	Describe one thing you struggled with while trying to accomplish your goal. <i>[open]</i>	The main challenge I encountered while trying to achieve my goal this week was: <i>[forced choice]</i>
Adaptations made in response to challenge	Describe what you did to address that struggle. <i>[open]</i>	To address this challenge I did the following: <i>[forced choice]</i> Explain or elaborate about how you addressed your challenge... what did you do specifically? <i>[open]</i>
Evaluation of adaptations made	How successful was that approach? On a scale from 1 to 10, my approach was... (1 = not very successful to 10 = very successful) <i>[open]</i> Explain what worked well and what didn't work well. <i>[open]</i> How could you change or improve what you did? <i>[open]</i>	
<i>Planning Section</i>		
List of tasks for the week in order to focus goal setting on one task		Something I would personally like to strive for this week is to: <i>[open]</i> The course I would like to focus on in my goal setting activity this week: <i>[open]</i>
Specify the task of focus	Name one specific task (e.g., a reading, an assignment, studying, etc.) to focus on this week. <i>[open]</i>	Tasks I want to accomplish in this course this: <i>[open]</i>
Set a goal	Set one SMART goal for the task you have chosen. <i>[open]</i> What is your goal about? <i>[forced choice: learning, behaviour, motivation, feelings, time management/organization]</i>	Choose a task and set one SRL goal for this week.
Rating of learners'	How challenging or difficult do you think your goal is this	How challenging is this goal for me? <i>[forced choice: 1 easy,</i>

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perception of the goal difficulty	week? On a scale from 1 to 10, my goal is... (1 = not very challenging to 10 = very challenging). <i>[open]</i>	<i>2, 3 moderately challenging, 4, 5 extremely challenging]</i>
Rating of learners' confidence to achieve the goal	How confident are you that you will accomplish your goal this week? On a scale from 1 to 10, I am... (1 = not very confident to 10 = very confident). <i>[open]</i>	How certain am I that I can achieve the goal I have set this week? <i>[forced choice: 1 cannot do it at all, 2, 3 moderately certain I can do it, 4, 5 highly certain I can do it]</i>
Open area to allow learners to comment on anything important for them		Comment on anything that is going on for you academically at the moment, or that has happened in the past week. This may be any struggles you have faced, worries you have had, or achievement you have made. This is your open space to tell us about your semester.

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## Appendix B

*RLQ Item Loadings for Step 1 EFA with 4- and 5-Factor Solutions*

Item	Four-factor EFA								Five-factor EFA									
	Time 1				Time 2				Time 1					Time 2				
	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5
B1	.70				.78				.71					.78				
B2	.48				.51				.48					.66				
B3	.70				.60				.71					.53		.31		
B4	.69				.55				.64					.60				
B5	.32								.30									
B6	.74				.63				.71					.61				
B7	.33				.32						.60			.43				
B8	.31				.31									.38				
B9	.62				.32		.30		.61									
B10												.96						
B11							.32					.66					.30	
B12		.64					.75				.65							.85
B13		.49					.67				.50							.84
B14	.42	.37			.31	.33			.40	.38								.39
B15		.61				.64				.62								.59
B16		.43				.45				.44								.52
B17		.42				.47				.42								.33
B18		.58			.41					.58				.46				
B19		.42				.40				.42								.30
B20		.38			.35					.39								
A1		.40					.51			.39				.40				
A2				.51			.65						.51	.31	.54			
A3				.65	.33		.57						.65		.56			
A4				.83	.32		.57						.82		.67			
A5				.78	.33		.57						.79		.53			
A6		.63					.45			.64				.59				

## Appendix B Continued

*RLQ Item Loadings for Step 1 EFA with 4- and 5-Factor Solutions*

Item	Four-factor EFA								Five-factor EFA									
	Time 1				Time 2				Time 1					Time 2				
	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5
A7		.75				.31	.54				.76							.48
A8		.59					.37				.58							.32
A9		.51					.51				.51							.54
A10		.43					.42				.45			.35	.46			
A11		.48					.31				.48							.55
A12		.78					.66				.80							.67
A13		.58					.67				.60							.41
A14							.33		.35			.34						.37
A15									.32									.30
A16		.40					.48				.42							.37
A17		.84					.59				.84							.83
A18		.84					.73				.85							.72
A19			.31									.35						.33
A20		.41	.37								.42	.39						.56
A21			.67									.69						.63
A22			.88									.92						.80
A23			.84									.89						.83
A24			.69									.69						.69
A25			.44									.36						.58
A26														.35			.32	
A27					.46													.40
A28			.37					.38						.30				
A29	.34									.35								

*Note.* Only factor loadings >.3 are shown.

## Appendix C

*Items Dropped from RLQ*

No	Item	Scale	Reason
<b>Step 1</b>			
B5	Figured out how I will be graded	TU	low factor loadings
B7	Discussed what I am supposed to study (peers, TA, professor)	TU	low factors loadings at Time 1, loading on different factors at Time 2
B10	Asked someone what we were supposed to know or study	TU	low factor loadings
B11	Asked someone how we were supposed to study	TU	low factor loadings
B14	Set goals that focused on learning, understanding, or remembering	GP	loading on two factors (TU and GP)
B18	Estimated how much time my work would take	GP	loading on different factors at different times
B20	Prioritized what I needed to do	GP	low factor loadings, loading on different factors at different times
A14	Realized that I didn't know something or hadn't read something	EV	low factor loadings, loading on different factors at different times
A15	Realized that I wasn't understanding something	EV	low factor loadings, loading on different factors at different times
A19	Found I couldn't complete my goals at the end of a 1-2 hour time block	EV	low factor loadings, loading on different factors at different times
A26	Talked myself into working a little longer	AD	low factor loadings, loading on two factors
A27	Told myself it would be ok	AD	low factor loadings, loading on different factors at different times
<b>Step 2</b>			
B19	Created a study plan or to-do list	GP	loaded on Goal Setting only in 4-factor solutions; not consistent with other Goal Setting items
A29	Reduced my anxiety about the upcoming test	AD	low factor loadings

## Appendix D

*RLQ Item Loadings for Step 2 EFA with 4- and 5-Factor Solutions*

Item	Time 1				Time 2				Time 1					Time 2				
	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5
B1	.70				.79				.71					.81				
B2	.48				.55				.52					.62				
B3	.73				.61				.75					.55				
B4	.67				.54				.66					.57				
B6	.74				.65				.74					.63				
B8					.32									.35				
B9	.64				.31				.65							.36		
B12		.62						.82		.69								.87
B13		.48						.73		.41								.83
B15		.61						.63		.58								.61
B16		.40						.52										.53
B17		.39						.49										.38
B19		.36						.45						.32				.34
A1		.41					.50		.42			.32				.37		
A2			.49		.31	.62						.48			.70			
A3			.65		.32	.56						.65			.71			
A4			.86		.30	.54						.88			.74			
A5			.81		.30	.58						.85			.65			
A6		.64				.51			.46					.62				



## Appendix E

Table E1

### *Individual Qualitative Profiles for Unengaged Regulators*

	<b>P242</b>	<b>P253</b>	<b>P280</b>	<b>P320</b>	<b>P444</b>
Age	20	18	22	18	19
M/F	Female	Female	Male	Male	?
101	5	4	6	5	3
GPA	4.5	5.25	4	5	1.8
TU	N/A	Low	Low	Low	N/A
GO	Low	Low	Low	Improving	Improving
M/E	Low	N/A	Improving	Low	Moderate
AD	Low	N/A	Low	Low	Moderate
MET	Improving	N/A	Low	Low	Moderate
MOT	Low	Low	Low	Low	Moderate
Desc	No TU evidence Goals were to do lists, some with specific actions Becomes more specific and realistic around time, which was important as she continually struggled with procrastination Some attempts to apply 101 concepts Monitoring, evaluating, and adapting related only to time	No completion of the <i>reflecting</i> portion, thus unable to rate Seems to have missed purpose of Weekly Reflections, indicating poor TU Weak goals across semester	Consistently poor quality goals Improved descriptions of challenges and addressing challenges, but monitoring rarely took place against standard set in goal Lack of responsibility for his work Continual struggle with procrastination, no evidence of addressing	Monitoring, evaluating, and adapting only related to environment. Struggle to understand tasks or that university required active learning Goals improved in terms of standards and actions but inconsistent	Only completed 7 weeks of Weekly Reflections Inconsistent improvement in goals Monitored against standards in goals and monitored usefulness of adaptations High levels of stress that continue to increase Attempts to apply 101 concepts in goals and motivation

*Note.* 101 = Grade in ED-D 101, on a 9-point scale. GPA – Grade Point Average, on a 9-point scale. TU = Task Understanding. GO = Goals. M/E = Monitoring and Evaluating. AD = Adapting. MET = Metacognitive awareness. MOT = Motivation. Desc = Description of main points. N/A = Not enough information to rate.

Table E2

*Individual Qualitative Profiles for Active Regulators*

	<b>P246</b>	<b>P290</b>	<b>P338</b>	<b>P369</b>	<b>P461</b>
Age	19	19	31	17	20
M/F	Male	Female	Male	Female	?
101	8	4	8	6	8
GPA	5.6	3.75	4.5	2.75	6
TU	Low	High	N/A	Low	High
GO	Low	Improving	Improving	Moderate	Improving
M/E	Moderate	Moderate	N/A	Moderate	High
AD	Improving	Moderate	N/A	Moderate	High
MET	Moderate	Moderate	Low	High	High
MOT	Moderate	Moderate	High	Moderate	High
Desc	Struggled with TU Large, vague goals with little specificity Some specificity in describing challenges Adaptations mostly came from help seeking with some other strategy changes Metacognitive awareness mostly around TU	Evidence of adapting Continual struggle with time and motivation suggests unsuccessful adaptations Broad, open goals became more specific Clear attempts to improve her learning	Slight increase in goal specificity but focused on task completion No challenges Seems metacognitively unaware, but only taking one other course, compared to normal Engineering course load	Struggling with TU Goals had strong standards but poor specificity in concepts Monitored and evaluated success of strategies, though little monitoring of learning standards Metacognitive awareness around TU, importance of strategy choice, and time management	Clear emphasis on TU right from start of semester Created her own goal scaffold Consistent evidence of monitoring learning and adapting to challenges High self-awareness in many aspects Attempts to apply 101 concepts

*Note.* 101 = Grade in ED-D 101, on a 9-point scale. GPA – Grade Point Average, on a 9-point scale. TU = Task Understanding. GO = Goals. M/E = Monitoring and Evaluating. AD = Adapting. MET = Metacognitive awareness. MOT = Motivation. Desc = Description of main points. N/A = Not enough information to rate.

Table E3

*Individual Qualitative Profiles for Struggling Regulators*

	P319	P341	P368	P386	P439
Age	19	22	18	23	18
M/F	Male	Male	Male	Male	Male
101	8	6	6	5	5
GPA	7.25	4.6	4.5	6.2	6
TU	Moderate	Improving	Low	High	N/A
GO	Improving	Moderate	Low	Moderate	Improving
M/E	Low	High	Low	Moderate	High
AD	N/A	Moderate	Low	Low	High
MET	Low	High	Moderate	Moderate	High
MOT	Moderate	Moderate	Moderate	Low	High
Desc	Monitoring mostly around grades, not related to learning Little evidence of adapting; often perceived there was no challenge Procrastination was mentioned several times but never described as problem to deal with Some attempts to understand task Little evidence of metacognitive awareness Seemed pretty content with his learning	Some improvement in goals with scaffold Monitoring and evaluating specific throughout Demonstrated awareness of own learning processes Some attempts to adapt; mostly surface but a couple around learning More proactive in trying to understand tasks throughout semester	Evidence of struggling with TU; metacognitively aware of this with some attempts to address this Some evidence of monitoring performance after the fact and not being happy with results Attempted to address environmental challenges but reported same challenge many weeks Goals were poor all semester Metacognitive awareness of some issues but poor specificity in monitoring	Proactive in understanding tasks Goals had specific concepts and actions but lacked standards Monitored and evaluated strategies but no evidence of adapting strategies Assessment of challenges seemed at odds with descriptions Some evidence of adapting the environment and motivation but continued to struggle with this throughout semester	Evidence throughout semester of adaptations and monitoring effectiveness of changes Same challenge week-to-week but persistent in making changes and evaluating Goals improved though sometimes still vague Good awareness of issues Attempts to apply 101 concepts

*Note.* 101 = Grade in ED-D 101, on a 9-point scale. GPA – Grade Point Average, on a 9-point scale. TU = Task Understanding. GO = Goals. M/E = Monitoring and Evaluating. AD = Adapting. MET = Metacognitive awareness. MOT = Motivation. Desc = Description of main points. N/A = Not enough information to rate.

Table E4

*Individual Qualitative Profiles for Emergent Regulators*

	<b>P229</b>	<b>P308</b>	<b>P388</b>	<b>P393</b>	<b>P437</b>
Age	18	18	20	19	21
M/F	Male	Female	Female	Female	Female
101	8	5	7	3	5
GPA	7	3	5.8	3.33	4.8
TU	Low	High	N/A	N/A	Improving
GO	Low	Improving	Improving	Improving	Improving
M/E	Low	High	N/A	N/A	Moderate
AD	Moderate	High	Moderate	Moderate	Moderate
MET	Moderate	High	Low	Low	Moderate
MOT	Moderate	High	Low	Low	Moderate
Desc	Evidence of adapting, around time/organization Struggle with understanding tasks but able to address this Improved in awareness of TU Found 2-hour goals effective though his goals were large, multi-session Monitored test scores and by “feel” but no learning standards	Improvement in goals, especially standards but not consistent Evidence attempts to better understand tasks Specific in monitoring Proactive in making changes and taking feedback into account	Goals improved from very poor Consistent evidence of adapting learning and environment to attain goals No evidence of monitoring Metacognitive awareness of repeated or continual struggles tended to be low	No evidence of monitoring or TU except on small incident of poor TU Goals were continually improved in concepts and actions Some evidence of adapting time and environment but no learning processes Little evidence of being self-aware of similarity in challenges week-to-week	Goals improved from vague multi-session TU evidenced in use of Weekly Reflections and specificity in concepts Monitored and evaluated time but not learning Evidence of adapting to challenge A lot of planning challenges Some awareness time and motivation issues

*Note.* 101 = Grade in ED-D 101, on a 9-point scale. GPA – Grade Point Average, on a 9-point scale. TU = Task Understanding. GO = Goals. M/E = Monitoring and Evaluating. AD = Adapting. MET = Metacognitive awareness. MOT = Motivation. Desc = Description of main points. N/A = Not enough information to rate.



# Similarities and differences in self-regulated learning processes in sport and academics: A case study

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## Abstract

Self-regulated learning (SRL) competencies have been suggested to contribute to student-athletes' concurrent success in sport and academics, yet transfer of SRL across learning domains remains understudied. The purpose of this research was to explore the possibility of SRL transfer by using case study to (a) extend Winne and Hadwin's (1998) model of self-regulated studying to sport training, and (b) examine similarities and differences in SRL processes of a student-athlete in sport and academic contexts. Case study provided an ideal methodology to allow for in-depth, in-context inquiry into learning in sport and academic contexts using multiple data sources. The participant was a male, international-level table tennis player enrolled in a first year university program. He completed a semi-structured interview, video-stimulated recall interviews in sport and academics, and journal entries centered on daily goals in sport and academics. Coding of the data was both data-driven, drawing on Winne and Hadwin's model, and theory-driven. The participant engaged all phases of regulation in both contexts demonstrating the applicability of a model of self-regulated studying to sport training and suggesting he used the same processes to succeed in both contexts. However, he demonstrated a more proactive approach and a closer relationship with his coach in sports than in academics. That learners may develop more sophisticated SRL in sport opens avenues for supporting student-athletes' regulation in other contexts such as academics.

Keywords: sports; academics; self-regulated learning; metacognition; athlete; transfer

## Introduction

Though athletes are often considered “not the brightest bulbs in the collegiate lamp” (Brand, 2008), research suggests athletes are successful in academics as well as in sport. Though athletes commit a large number of hours to sport training (Watt & Moore 2001), they demonstrate grade-point averages (GPA) and graduation rates similar to non-athletes (e.g., Aries et al. 2004; Watt & Moore 2001). Umbach, Palmer, Kuh, and Hannah (2006) found athletes at all Division levels of American college athletics reported similar levels of engagement in “educationally purposeful activities” (p.78), such as active and collaborative learning. Durand-Bush and Salmela (2002) described the World and Olympic champions they interviewed as “high achievers in both sport and school” (p.165); however, factors that promote concurrent success in sport and academics remain unclear.

Marsh (1992, 1993) suggested benefits of high school sport participation are due to enhancement of school identity, involvement, and commitment, while Eccles and Barber (1999) suggested benefits of sport are due to engagement in a social network that affects identity. However, these theories focus on sports that are school-based and research with European youth athletes who participate in club-based sports also supports the notion that athletes are successful in sport and school (e.g., Brettschneider 1999; Jonker et al. 2009). In addition, Marsh (1993) and

Eccles and Barber (1999) focus on recreational participation, while much of the research on athlete success in school has focused on competitive athletes, often considered “elite” level athletes in their sport (e.g., varsity athletes in college). The goal-driven nature of competitive sports may provide a platform for developing self-regulated learning (SRL) that transfers to academic learning settings, an idea that has recently been gaining ground in the literature (Jonker et al. 2009). Of course, it is also plausible that regulatory competencies in academics encourage SRL in sport contexts.

Self-regulated learners take an active approach to learning by planning, monitoring, and adapting in order to reach self-set goals (Winne 1997, 2001; Winne & Hadwin 1998; Zeidner et al. 2000; Zimmerman 1986, 1989). Self-regulated learners are motivated and persist through challenges. These learners regulate their cognitions and behaviour, as well as regulating their motivation and affect (Pintrich 2000). Research points to the importance of self-regulated learning (SRL) for success in academics (e.g., Kitsantas 2002; Zimmerman & Martinez-Pons 1990) as well as for success in sport (e.g., Cleary & Zimmerman 2001; Toering et al. 2009). Several models exist to explain SRL in sport (e.g., Kirschenbaum 1987) and academic contexts (Boekaerts 1996; Pintrich 2004), though Zimmerman’s (1998, 2000) model is the only one that has been used to date in both settings. Winne and Hadwin’s (1998) model was chosen for this research because (a) they detail how work is accomplished within *and* across phases of their model, and (b) they separate task perceptions and goals allowing for nuanced examination of learning (Greene & Azevedo 2007).

Winne and Hadwin (1998) posit SRL occurs over four, loosely sequenced, recursive phases. In Phase 1, *task perceptions*, learners construct a personal definition of the task at hand. Guided by the products of Phase 1, learners create standards for their work and plan how to accomplish it in Phase 2, *goal setting and planning*. Phase 3, *task enactment*, involves engaging the decided-upon tactics and strategies to complete the task or work towards the goal. Phase 4, *adaptation*, is optional. In this phase, learners make large-scale adaptations to task perceptions, goals and plans, and/or tactics and strategies. Phase 4 is especially critical when learners face challenges (Hadwin et al. 2011) as this provides an opportunity to modify learning processes. This means metacognitive monitoring and evaluating processes are central to SRL by guiding learners to know when and how to adapt.

Winne and Hadwin (1998) further posit a cognitive architecture, known by the acronym COPES, that describes how learners navigate within and across phases. *Conditions* refer to the internal and external factors perceived by learners to surround their work. Perceived conditions guide choice of *operations*, the cognitive work done in each phase. Operations create *products* in each phase that become conditions for the next phase. Products are *evaluated* against *standards*. Thus, monitoring and adapting occur both at the level of each phase (e.g., monitoring task perceptions) and at the level of the broader task (e.g., monitoring goal progress).

Examining SRL as a potential link between sport and academic contexts means looking at the domain-specificity or transfer of SRL. A small body of literature exists suggesting metacognition is a domain-general skill, applicable in all learning domains (e.g., Veenman & Spaans 2005; Veenman et al. 2004). Further, benefits of training in metacognition have extended beyond the domain of initial learning (e.g., Adey & Shayer 1993; Sanz de Acedo Lizarrage et al. 2003). One limitation of this area of research to date is a focus on metacognition, the monitoring and control of cognition (Flavell 1979). While metacognition is critical for SRL, self-regulated learners also monitor and control behaviour, motivation, and affect (Dinsmore et al. 2008). Another limitation of this research is a focus on only academic domains without examining

relationships between SRL in sport or other non-academic learning contexts. McCardle, Jonker, Elferink-Gemser, and Visscher (2014) reported high, positive correlations between regulatory processes in sport and academics for competitive youth athletes. However, no other research to my knowledge examines SRL in sports and academics.

Understanding whether SRL transfers between learning contexts is an important question for the field. When Bransford and Schwartz (1999) stated, “A belief in transfer lies at the heart of educational system” (p.61), they were referring to transfer of knowledge and content. But as educational emphasis shifts in the 21<sup>st</sup> century to lifelong learning (e.g., Conference Board of Canada 2001; Longworth 2003) it is critical to understand whether and how these learning skills transfer between contexts but little empirical research has addressed this implicit assumption (Crick et al 2014). SRL research to date has focused solely on how learners regulate within one context, but if regulatory competencies are to be helpful for learners, they should be applicable across multiple, varied contexts. Transfer of SRL opens up potential avenues for helping students to develop regulatory competencies in learning contexts beyond the classroom and for helping struggling students to draw on experiences in other learning domains, such as sport.

Thus, the purpose of the present study was to investigate one student-athlete’s perceptions of his self-regulated learning processes in both learning contexts. Four research questions were addressed using case study methodology: (a) How did the participant regulate in academics? (b) How did the participant regulate in sport? (c) What similarities were evidenced in how the participant regulated learning in sport and academic contexts? and (d) What differences were evidenced in how the participant regulated learning in the two contexts?

## **Method**

### **Case Study**

Researchers have touted the benefits of qualitative inquiry for studying SRL (Butler 2002, 2011; Patrick & Middleton 2002; Perry 2002; Winne & Perry 2000), yet this remains an under-utilized approach in the field. Case studies have been used to look at teachers support for students’ SRL (Ozdemir & Pape, 2012; Perry, 1998), interventions designed to improve student SRL (Cleary & Platten, 2013), and students’ strategy use in web-based courses (Whipp & Chiarelli, 2004). In sport, case studies have been used to examine emotion self-regulation (Cohen, Tenenbaum, & English, 2006; Prapavessis, Grove, & McNair, 1992). To my knowledge, no case studies have been conducted to examine athlete learning or to examine self-regulated learning in two unique contexts. Qualitative case study is a methodology of in-depth, in-context empirical investigation using multiple data sources for one or few cases (Baxter & Jack 2008; Yin 2009). Case studies are appropriate for answering *how* questions, for investigating situations in which there is no manipulation of behaviour, and for including contextual conditions (Baxter & Jack 2008), making case study an ideal methodology for investigating how a student-athlete regulates learning in sport and academic settings. Further, case study was appropriate for this research because this methodology is appropriate when a priori theory is used to guide data collection and analysis (Yin 2009).

In addition, case study methods emphasize multiple, equally valid social realities and knowledge as co-constructed (Haverkamp & Young 2009). This type of constructivist approach (Baxter & Jack 2009) is well suited to Winne and Hadwin’s (1998) model of SRL because this model situates learning in context and acknowledges learners’ decisions and actions are based on their perceptions. Further, constructivist approaches acknowledge the researcher influence on the research process (Haverkamp & Young 2009). In this case, my background as a competitive athlete and coach, along with my experience as student, influence my understanding of what

those contexts are like, how learners regulate in those contexts, and what supports for SRL are generally in place. This allowed me to develop rapport with the participant and informed how I interpreted the data.

### **Participant**

Data were collected from six participants; however a single, in-depth case study was deemed appropriate because (a) the purpose was to examine the application of Winne and Hadwin's (1998) model to sport and to explore similarities and differences in SRL across sport and academics and (b) there has been almost no work examining student-athlete regulation across two contexts. This allowed me to explore in-depth evidence of the SRL cycle and to look for other characterizations of learning that were similar and different across contexts. Camiel (pseudonym) was chosen from the potential participants because he provided a rich array of data that was thoughtful in both contexts, allowing for examination of similarities and some striking differences in SRL.

Camiel was a 19-year-old male who played table tennis at an international level and was enrolled in his first year as an undergraduate student. He was recruited through his academic department at a university in Europe because of his participation in elite level sport. Camiel's participation in table tennis at an international level was not through a university team; thus, while I refer to Camiel as a student-athlete, he was not a student-athlete in the American sense of competing for his university.

### **Data Collection**

Four types of data were collected: (a) one semi-structured interview, (b) ten structured journal entries (5 for each of sport and academic work), (c) one sport observation and video-stimulated recall, and (d) one academic observation and video-stimulated recall. Field notes were recorded during observation sessions and after interviews and used for contextual and interpretive purposes. The institutional review board approved all procedures and informed consent was obtained at the beginning, with reminders at each stage of data collection.

**Semi-structured interview.** Data collection began with an audio-recorded semi-structured interview (70 minutes). Interview questions (Appendix A) were designed to create opportunities for the participant to talk about his approach to learning in both contexts. The interview was semi-structured with questions functioning as a guide but not dictating the flow of the interview. The interview started with basic demographic information, building rapport, and describing a typical study and training session. Questions wove back and forth between sport and academic learning contexts as we went through one cycle of the SRL phases set out by Winne and Hadwin (1998). For both sport and academic contexts, I asked for a recent, particular example of a challenge faced and how the student-athlete handled it. The interview concluded with the role of peers in each context and how the participant felt his learning in sport and academics was connected. This idea was left until the end so as not to influence the ways in which the participant spoke about or connected his learning throughout the interview. Throughout the paper, data excerpts from the interview are denoted with "IV".

**Training and study journals.** The structured journal entries were designed to collect specific examples of Camiel's goals, challenges faced in reaching those goals, and how he adapted in the face of those challenge (see Appendix B). Each of five training sessions and five study sessions were recorded as separate entries in the journal. Structured journals prompts were emailed to Camiel as excel files, with one sheet per journal entry for each of the two contexts. Camiel was encouraged to complete consecutive journal entries immediately after each training or study session, whenever those sessions occurred naturally in his life. In the event a journaling

opportunity was missed, Camiel was instructed to simply to move to the next session rather than trying to create a retrospective entry for the missed session. Data examples from the Training Journals are denoted “TJ” and from Study Journals as “SJ” with entry numbers (1-5).

**Observation.** An observation session was conducted with Camiel for one academic study session and one training session. Observation sessions were conducted at a time and place convenient for Camiel. Observation videos were not formally part of the analysis, but were referred to as context for interpreting statements in video-stimulated recall interviews.

**Video-stimulated recall.** Video-stimulated recall (VSR) interviews followed immediately after observation sessions and were audio-recorded. The purpose of the VSR was to focus on participant- and researcher-identified challenges faced in that particular session identified in the observation video and to walk through the episode. Winne (1995) makes the case that SRL involves both deliberate and non-deliberate engagement of cognitive processes; learners are most likely to deliberately engage in SRL when they face difficulties (Hadwin, Järvelä, & M. Miller, 2011). Thus, challenge episodes were chosen for the focus of the VSRs because it was assumed learners would deliberately engage in self-regulatory processes in response to challenges and be able to speak to and recall these processes. In both sport and academic VSRs, Camiel was able to talk freely about the challenges and how he addressed them with little reference to the video. As much as possible, focus was redirected to particular challenge, though Camiel often made generalization and connections to other “typical” training and study sessions. Further questions were asked to clarify the phases of SRL in that particular instance, such as, “Did you have a goal and did it change at all during the session?” The sport VSR was 35 minutes while the academic VSR lasted 15 minutes. Data from Sport VSR is denoted “SV” and Academic VSR as “AV”.

### **Analysis**

Semi-structured and VSR interviews were transcribed for analysis. Analysis unfolded over four steps. *Step 1* involved listening to all interviews and reading and re-reading the transcripts to familiarize myself with the data followed by reviewing Camiel’s training and study journals and my field notes.

*Step 2* involved inductive and deductive coding of the data. Coding was initially loosely guided by Winne and Hadwin’s (1998) COPES typology, but the grain size of this theory did not fit the level at which Camiel spoke about his training or even reported in his training and study journals. Thus, the phases of studying proposed by Winne and Hadwin were used as a guide, but specific characterizations of each phase were made. Statements related to cognition, motivation, the combination of school and sport, peers, and examples of different phases of SRL were highlighted and labeled with a code or researcher commentary. For instance, when Camiel said, “You really feel when it’s good and when you, you know, it’s just this feeling you have. When you touch the ball for example you already know” (IV), this was labeled *monitoring by feel*, with monitoring being one phase of SRL. Statements ranged in length from phrases to several sentences when Camiel described different elements of one phase of SRL. The interview was coded in its entirety; coding of different phases was not limited by the interview questions that were also formulated around Winne and Hadwin’s model. For instance, when asked about his goals, Camiel stated “then for anatomy I’m done for this week because there’s really not more to learn because we’re just going further with the body next week” (IV), and this was coded as *task understanding related to course as a whole*.

In *Step 3* a second pass of the data was used to organize codes and examples into themes. Two categories of themes emerged. Five theory-driven themes were based on Winne and

Hadwin's (1998) model of SRL: the phases of *task understanding*, *goal setting*, and *adapting*, as well as *challenges* and *monitoring/evaluating* (see Table 1). The intertwined nature of phases of SRL meant, it was possible for a code to fit more than one theme. Two additional data-driven themes beyond phases in Winne and Hadwin's model were identified and used to categorize remaining codes including *big picture* and *metacognition* (see Table 2).

*Step 4* involved creating one statement to characterize each theme for each context, referencing the data for each theme to do so. Transcripts and journals were reviewed once more, actively searching for evidence contrary to any of the theme statements. Any additional data identified in this step to each theme's list of codes. The final list was used to create descriptions of Camiel's engagement of SRL processes in his sport and academic pursuits.

### **Rigour**

Procedures for assessing quality of qualitative research are less standardized than those for quantitative work (Gibbert & Ruigrok, 2010; Morrow, 2005), thus I explicitly outline the ways in which I addressed validity and reliability in this study. First, to ensure construct validity, I used multiple data collection strategies by collecting interviews, VSR interviews, and Study and Training Journals, and I described a "chain of evidence" (Gibbert & Ruigrok, 2010) from research questions to findings, by detailing steps of the analysis. To address internal validity, I systematically analyzed the data looking for counter-evidence of ideas. Further comparison to deviant cases is beyond the scope of this paper but is planned for future research. In case study research, external validity or generalizability refers to analytical generalization from empirical observation to theory. As such, Camiel's case was purposefully selected because of his status as an international level athlete, which allowed me to generalize Camiel's regulation to Winne and Hadwin's (1998) model. Reliability was addressed by providing multiple data excerpts for each theme.

## **Findings and Discussion**

### **How Did Camiel Regulate in Academics?**

Camiel was in his second semester of studying in courses such as anatomy and mathematics, with a self-reported GPA of "seven point something" on a 10-point scale. Camiel reported spending "not really much" time on studying, about one to two hours outside of class time each week. He reported very few challenges in his academic learning stating, "I study very easily" (IV; *challenges*). Camiel had not yet faced any academic challenges in terms of content or difficult tasks. He mentioned discipline as one of his challenges around getting started on his work: "til now I'm smart enough to get everything and know everything and learn everything but sometimes after a hard practice then you know, I am just tired and I just want to watch TV and not think about a lot things. So, yeah, then it's difficult for me to motivate myself to, yeah, really start with something." (IV; *challenges*). When he was tired or unmotivated, he chose to think about deadlines or "about my exams I need to pass" (SJ1,2; *big picture*).

Camiel described taking a systematic approach to studying, based on his perceptions of what academic tasks required. He evidenced being able to break down a task into its respective elements. For instance, he broke the body into groups to study for his anatomy class, such as "...the shoulders or stuff like that. So then I just focus on that particular part and I just put that all down" (IV; *task understanding*). He also prioritized what was important at this stage for his math class: "I think I just really need to learn this method and don't think about practical applications yet" (AV; *task understanding*). Further evidence of his understanding of the tasks was demonstrated by matching learning approaches with the task. For example, "some things are

Table 1  
*Theory-Driven Themes*

Theme	Description	Sport Example	Academic Example
Task Understanding	Perceptions of requirements for tasks/movements, what constitutes doing the task/movement correctly, how tasks fit together	So, yeah, I think that's mostly what it's all about. When I'm aggressive and I attack, most of the time then you can say almost every time that yeah, that's good (IV)	You know, if you know the method, you can put it one you can put it to thousands. You know the method and then it's easy. (AV)
Goal Setting	Descriptions of an aim or desired result, mostly for one particular session	I always, um, give myself assignments so before every rally or stuff like that then I just say well, um, I think about this, this, and this, and you just repeat that over and over again... (IV)	Well, um, because I'm always organized I sit down and make like end goals for the end of the week. By the end of the week, I have to have done this, this, this, this, and this (IV)
Monitoring and Evaluating	Keeping track of one's own performance level during training or studying or in competition or formal assignments and comparing it to one's own standards	...when I'm at nine-nine for example and I just serve really really bad and I'm gonna make really bad mistakes and maybe I was mentally too stressed and I still maybe win by you know, big, big luck. So it was not a good performance. [...] it's really a combination of all those things (IV)	...sometimes you're really tired and you just can't get it in your head and then say well I quit because [...] I don't feel like it or I can't focus, so, but um, yeah, of course you monitor but it's not that I speak it out loud for like, my performance now was like, an eight... (IV)
Challenges	Difficulties faced in training or studying	I recovered and I was really on time so it was like really good points [...] so be happy and try and keep that steady. So that was more like the challenge. (SV)	Well my biggest challenge most of the time is discipline and motivation (IV)
Adapting	Making changes in an approach when something is judged as not going well, or continuing when judged that it is going well	Sometimes, maybe the first exercise we'll continue for 15 minutes because we played really bad, you just first want to improve a little bit before you change (SV)	Yeah, well during solving the problem I thought, well something goes wrong [...] What I had to do different was difficult, but then I just check the rules again and again (AV)

*Note.* IV = interview; SV = sport VSR; AV = academic VSR

Table 2  
*Data-Driven Themes*

Theme	Description	Sport Example	Academic Example
Big Picture	Keeping in mind the purpose beyond what is happening in one particular session	Although it looked like, it doesn't matter, you're 2-0 ahead, but it's if you can beat your opponent really easy, then next time he'll be "Oh, I lost so bad..." Yeah, it's important to also do in practice (SV)	...then for anatomy, I'm done for this week because there's really not more to learn because yeah, we're just going further with the body next week (IV)
Metacognition	Being aware of one's own strengths and weaknesses, the process of learning, and strategy knowledge	...when the exercise is going well then keep doing the exercise so you can make it automatically [...] and when it doesn't go well, make sure that it goes well before you do something else. Because otherwise you did all that stuff for nothing. (IV)	When I study, I'm really studying, I'm not doing anything else [...] I really need to focus because otherwise, then it doesn't work, so. (IV)

*Note.* IV = interview; SV = sport VSR; AV = academic VSR

just like, you have to remember them so it's like easy learning, you just have to push, push, push" (IV; *task understanding*).

Camiel's academic goals were "not that detailed" (IV; *goal setting*) and focused mostly on completing tasks. "I mostly have a checklist and I have to do this but I don't say, well it has to be perfect [...] of course, when it has to be done, then it has to be perfect but not before I don't think" (IV; *goals*). He had performance standards and general ideas about how to achieve that in his anatomy class:

I always study for like, a ten [...] I just want to remember everything and everything always and every context and situation so when I can repeat that over and over again in my head and you know, point to myself and stuff like that then I know that I know everything and so that there is nothing left to learn. And when I can explain it to somebody else, then it shows for me that it must be good (IV; *goals*)

While Camiel did seem to have some standards focused on quality of learning, such as knowing the anatomy "not just by looking at the answers, but name them all by myself" (SJ2; *goals*), these were not always explicit in that he could not always describe what would make it perfect. He could not describe how he would know what a project worth 10 would look like. "You never really know," (IV; *task understanding*) he said. To monitor his performance he relied mostly on completing his checklist and monitoring effort: "when you look really objective to yourself and really reflect, most of the time you know by yourself if you've done everything you could and yeah, to get something and to give really 100% to this report or this exam" (IV; *monitoring*). Beyond that, he struggled to describe how he monitored in his academic learning.

Of course you monitor, but it's not that I speak it out like for like, my performance now was like, an eight [...] I don't grade it or stuff like that. Maybe it's just like, also with intuition I think. I think most people know when they um, yeah, really know something or when they don't really know it or stuff like that. Also in stuff like math you know the formula and you know how to do it but you're not really, really good at it. And also, then it's just, be objective to yourself and then you know [...] well I feel like I know this but is it true? So you're going to reflect so then you make assignments and stuff like that. (IV; *monitoring*)

Camiel also demonstrated adapting in the academic context. For instance, he reflected on his math exercises during the VSR.

*LM*: Do you feel you had a specific goal today when you started this work?

*Camiel*: Yeah, well I looked and we had one lecture, they discuss, I don't know how to say it in English but we had one topic. It's the second chapter of this book, so they already assume you know the first, and you can work the first one with no questions. I thought well, first I should maybe look at the first chapter and when I know I can go and move on to the next [...]

*LM*: Do you feel like your goal changed as you were working at all?

*Camiel*: Yeah, because I knew I wouldn't get the whole chapter, so it was like at first I thought this was easy, but at the first exercise, I already said, 'well, huh, what did they do?' I didn't know how it worked. So then of course it changed, and then I first needed to understand this completely before I can move on. (AV; *adapting*)

In this excerpt, Camiel's task perceptions involved thinking about what he would need to be able to understand the topics in Chapter 2 and he set a vague goal for working through Chapter 1. He had also made a metacognitive judgment about the difficulty of the task; but when he monitors his process in actually completing the first exercise, he modifies his perception of the difficulty

of the task. This prompts him to modify his goal to focus on Chapter 1. In addition, he describes monitoring his performance by checking answers and looking back in the instructions in the book to figure out “where did I go wrong, what did I miss” (AV; *monitoring*). Thus he used an objective standard and modified his approach from just doing the exercises to more strategically using the instructions to guide his learning. Camiel demonstrated adapting task perceptions, goals, and strategy use when his task engagement was not going as planned.

Overall, he understood what he needed to perform well in school and achieve “what I need to achieve – so I try to pass my exams of course” (IV; *task understanding/goals*). He realized he needed to use an agenda to keep track of his lists, “because otherwise there’s so many things in my head that you know, I just can’t think normally” (IV; *metacognition*). Camiel reflected generally on his academic weaknesses, such as “Math is not my strongest point” (AV; *metacognition*). He demonstrated some understanding of how he learned math best, believing improvement required time and effort: “At the end of the day, it’s still mathematics, it’s just practice and systematically exercise, then you’ll get it, it’s just a matter of time. If I don’t put enough time in, then for sure, I won’t get it” (AV; *metacognition*). He also understood personalizing his approach, such as linking anatomy “to my own sport or experience so that it’s also useful for me” (IV; *metacognition*).

Finally, Camiel recognized that his professors were available for help: “You know, like I [could] send him emails every day and every minute and I would get every minute an email back, but yeah, if you don’t feel like you have to then why should you email him?” (IV; *monitoring*). Yet, Camiel’s professors played little role in helping to develop his task understanding, create goals, or monitor his progress. He relied on getting grades, but this feedback was too late to help him change his approach if needed. He knew he could ask for more specific feedback, though he did not mention that this was something he did: “if you don’t pass an exam, you can always ask for the exam back and look at it and you know, converse with [the professor] about it and talk about it. You know, where you need to improve” (IV; *monitoring*). He mentioned seeking feedback from his mother if he was stuck in studying, but did not like to work with peers because “they’re not really disciplined and I think I know better than them [...] and also maybe my goals are harder” (IV; *goals/metacognition*).

In summary, Camiel demonstrated engagement of regulatory processes with task completion as the focus of his goals and monitoring. He evidenced task understanding by breaking down tasks into component parts and prioritizing components. Though he faced minimal challenges, he took responsibility for his own learning. He had metacognitive awareness for what worked for him but rarely linked this to the bigger picture of his development as a student or human movement scientist.

### **How Did Camiel Regulate in Sport?**

Camiel had played table tennis for ten years, with five years at national and international levels including having competed in World Youth Championships. He reported spending three to four hours per day training, both playing table tennis and doing physical preparation training. Camiel was extremely active in regulating his training, structuring his training in order to make him a better player in matches. In training, “some days you feel good, some days you don’t feel good, and yeah, you still have to be motivated and try to see the bigger picture” (IV; *big picture*). He purposely put himself in difficult situations to help his own development. “It is important to also practice sometimes under difficult circumstances. Because when you have a tournament, after multiple days, you feel very tired and you still have to give a good performance” (TJ4; *big picture*).

Further, he had very specific understanding of where his weaknesses lied as a table tennis athlete. For example, “I don’t move very well to my deep forehand” (SV; *metacognition*) and “I also tend to [give the opponent his momentum back] in matches” (IV; *metacognition*). Camiel reported facing “so many” (IV; *challenges*) challenges in his sport training, but he found the challenging aspects motivating. His descriptions of his challenges were very specific, for example, “to try to mobilize the strength I have to combine it with the technique and to put that into the ball” (IV; *challenges*). Most of his challenges focused on the mental side of training and the difficulty of being disciplined in his focus.

You know, when you’re training, you always try to improve, but when you are not training fully focused then, um, yea, you also make mistakes during the training. And then you will also improve your mistakes and train your mistakes and your mistake will become automatically so you really have to be extremely focused on that and sometimes that’s difficult (IV; *challenges/metacognition*).

This understanding of his challenges and weaknesses guided his focus during training and he consistently connected his training goals with goals for matches: “I have many focus points and those are my goals I think and when I work on that then my match goals, like tournament goals, you know, I will achieve them” (IV; *big picture/goals*). Camiel’s sport goals were very detailed: “Yeah, I think you can’t really get more detailed than that” (IV; *goals*). These goals focused on specific process behaviours in order to reach the outcome he desired: “if I say to myself, I want to be this end result, then I’ll never get that end result. When I say to myself to focus on, you know, stay down and move my body like this, this, and this then it will be like this and the end result is what I want it to be, then I did a good job” (IV; *goals*). He had multiple focus points that he was able to adapt even if the drill was the same. “You can make an exercise as big as you want because if you focus on all those points you know, take every time another point to work on then it’s really you know, changing all the time” (IV; *goals*).

Task understanding was important for Camiel because it allowed him to set specific goals and to prioritize. He broke tasks down into different technical elements and knew what to focus on and why. Reflecting on a play during the VSR, Camiel said, “I didn’t move [...] I was focusing on my wrist, but if you don’t move, then you have a problem” (SV; *monitoring/task understanding*). He understood that tasks are multi-layered with many pieces to focus on but “you try to focus on your focus point, the biggest and most important thing” (IV; *task understanding/goals*) and was able to prioritize: “if you forget the basics then you’re never going to get any expertise, it’s just impossible” (SV; *task understanding/metacognition*). He also drew on understanding of the tasks in order to match the learning approach to the task at hand: for each practice, he had “three or four things I really need to focus on and try to improve and [...] maybe three or four exercises to improve the different kind of things” (IV; *task understanding*). For instance, his general focus for the current training block was “technique for forehand” (IV; *goals*), so he focused on “footwork and movements with my hip and to the ball and shoulder” (IV; *goals/task understanding*).

Camiel’s understanding of the complexities of table tennis also allowed him to monitor multiple, specific elements: “The service, was it long? His return, was it long? [...] Or was it above the table and do you maybe need to be a little more passive? [...] It’s not really one thing particularly where you can say well, that makes it a really good thing or that makes it not a good job” (IV; *monitoring/task understanding*). When the outcome was not what he wanted, he searched, “was it my wrist, was it like this, was it that? You know it could be multiple things where the mistake was” (IV; *monitoring*). However, he also described a kind of intuitive

evaluation: “You really feel when it’s good and when you, you know, it’s just like this feeling you have. When you touch the ball for example, you already know [...] it’s really an instinct” (IV; *monitoring*).

Though table tennis is always played with an opponent, Camiel focused his monitoring on himself and his playing in training and tournaments. In matches, he evaluated solely his own performance: “I only look at my own performance because in table tennis you can’t look at the other because sometimes the other one has like, this super day, and everything goes well and yeah, then you really can’t do anything about it. And sometimes also then your opponent just sucks so bad that you can also give a bad performance yourself and still win” (IV; *monitoring*). His active monitoring and evaluating of his own performance points to the sense of responsibility that Camiel had for his development as an athlete. In sport, although he felt his relationship with his coach was important and had “a big impact” (IV), he took responsibility for his training, realizing his coach “can’t drill for me, I just need to do it myself” (IV; *metacognition*).

Camiel evidenced adapting his learning when faced with challenges. For example, he demonstrated a change in focus after a mistake.

*Camiel:* We played a match [in practice], it was 2-0 in games for me, and 2-0 in points, and he was like, I had him in pockets, you know, I knew I was gonna win. I made such an easy mistake, it was just good service, with no quality, and I missed that point. I also do that in matches, you know when I am comfortable when I lead, on top of my game, and then I tend to weaken my game, so the opponent can come back...

*LM:* And can get some momentum.

*Camiel:* So, really, I give him his momentum back, and because I also tend to do this in matches, this happened to me last Saturday so I was quite angry at myself that I missed such an easy point, and that was the whole idea behind it, that easy mistakes, you can never make easy mistakes, because when you make easy mistakes in practice for sure you’re going to do that matches. So yeah, I had to be a little bit tough on myself. You also see me like, how can I miss this one, and I repeat my stroke because of that. And here I just try and focus, new point, new momentum, and this was really good, so I recovered again, and good points, I found myself back. (SV; *adapting*)

Camiel evidences active perception of the task in understanding his weaknesses and using that to guide what he works on during the training match. He evaluates that he makes an “easy mistake” by missing the point when his partner serves. He thinks about what he needs to do instead and actually does an “air” stroke to remind himself how he wants to be performing. He modifies his focus or goal to recover and make the next point. Through the whole process, he is always aiming to improve not just in this training match but for when he plays in actual matches. Thus Camiel modifies his goal and his strategy in response to evaluating his performance as poor.

Overall, Camiel evidenced metacognitive knowledge about how to learn and his own strengths and weaknesses. He described a specific understanding of how he learned best in order to progress and perform.

It’s always it’s like progressive learning, first you... if you don’t know what you’re doing wrong then you get told by somebody that you’re doing something wrong then you know, oh I’m doing something wrong. And after that you try to improve and after a while, you get skilled a little bit, and then you know that you’re doing it well, but not always. So it’s not automatically you’re doing well. And after a couple of

weeks, maybe months, maybe years I don't know, then it just becomes second nature. And you're just doing it automatically. And when you do that, then you can go to the next step. (IV; *metacognition*).

He especially emphasized the importance of staying focused in terms of reinforcing and training the correct movements. He also specifically described the importance of creating “an environment of great motivation and a mindset: when you walk in, you want to practice and you want to work hard” (IV; *metacognition*). He understood his tendencies to “want always everything to be perfect right away” (SV) and had developed strategies to handle his emotions demonstrating self-knowledge.

Finally, Camiel's coach played a critical role in his development as an athlete. The coach helped Camiel to understand table tennis: “He really changed my way of looking at table tennis and changed my vision of it...he's really specific and really detailed about everything, about technique, yeah. He knows a lot of technique and yeah, what I said, technique in table tennis is everything” (IV; *task understanding*). Based on his work with his coach, he would know what to focus on in his individual sessions. “With my trainer, I do like the smart work and then for myself I do the stupid just push, push, push work” (IV; *metacognition*). Camiel also valued his coach's input in creating standards for his training. “He gives advice and ultimately maybe one time or two times he will say, oh, that was good, and then I have to remember and you know, remember what I did so then next time when I'm practicing by myself I can work on that” (IV; *monitoring/goals*). Camiel also set specific goals for his matches, which were discussed with his coach. “You have particular goals, you know, tactically and mentally and everything, and um, for a match you just talk to your trainer about it, about your goals and this match and where you have to focus on” (IV; *goals*). Importantly, practice goals were focused to optimize performance in matches and his practice goals were also shared with training partners. Camiel used both his coach and his training partners as resources for evaluating. In his Training Journal, he talked about how “my coach and I discussed this point of weakness in my game” (TJ2,3; *monitoring*) and used that evaluation to guide practice going forward. When his training partner helped him evaluate his recovery on a play, Camiel explained, “it's good about us practicing together, we also talk about things to each other and we know what we want to work on, and it's also easier, you know your training partner, he feels what your playing and what your quality is of the ball so he feels what you're doing, so it's easier for him to tell me and help me reflect what I'm doing with myself” (SV; *monitoring*).

In summary, Camiel was an active regulator in sport, demonstrating detailed understanding of table tennis. He set specific goals designed to meet bigger outcomes and address weaknesses. He monitored regularly and was able to describe how he learned best. Camiel took responsibility for his own training, but also took advantage of his coach and training partners to help him improve his training.

### **What Similarities Were Evidenced in How Camiel Regulated in Sport and Academics?**

Similarities and differences in Camiel's SRL are summarized by theme in Table 3. The similarities centered around his engagement of all phases of SRL proposed by Winne and Hadwin (1998) in both learning contexts: he had his own perceptions of tasks, set goals in both contexts, monitored his learning against implicit and explicit standards, and made changes when his evaluations were not favorable. This provides support for Jonker et al.'s (2009) assumption that self-regulation is relevant in sport and academic contexts. Often the regulatory processes seemed to be quite similar; for instance, Camiel described monitoring by feeling or intuition in both of these settings. However, the regulatory processes did not always look the same. For

example, in academics, understanding tasks (Phase 1) involved understanding the importance of being able to solve problems in Chapter 1 before moving on to Chapter 2. In sport, Phase 1 related to understanding that basics of footwork were prioritized before wrist and arm technical aspects. The role that these perceptions played in guiding the focus for each study or training session was the same. Thus the ways he engaged regulatory processes was often different in sports than in academics, but it was clear that he was engaging in activities for the same purposes: to understand tasks, to set goals, to evaluate progress, and to adapt when needed.

### **What Differences Were Evidenced in How Camiel Regulated in Sport and Academics?**

I also identified two key differences in Camiel's SRL. The first difference was the more proactive approach Camiel took in his sport when compared with academics; he seemed to invest more time, effort, and commitment to his athletic pursuits than his academics. In table tennis, everything was aimed at improving in practice in order to make those movements automatic for when he played matches. His focus in training was often based on where his weaknesses were in matches. He was continually focused on how to improve the process in order to improve the outcome and to figure out what went wrong in the process if the outcome was not where he wanted it. The characterization of Camiel as an active regulator is consistent with findings that expert athletes engage sophisticated regulatory processes (Cleary & Zimmerman 2001; Toering et al. 2009). In academics however, there was no sense of his development as a human movement scientist or active push to improve in areas he had previously had trouble. Though he mentioned the possibility of meeting with a professor if an exam did not go well, he did not describe having done that; there was much less evidence of proactively figuring out areas of weakness and attacking those. Yet, in sport, several times Camiel mentioned the importance of not training mistakes and staying very focused, a sign that he was proactively engaged in becoming the best table tennis player he could be.

Camiel's proactive approach to his table tennis suggests a high level of motivation for sport, while his more reactive approach to academics and fitting studying in around his training suggests less motivation for his academic work. This highlights the importance of motivation in SRL (Boekaerts 1996; Winne and Hadwin 2008). Camiel's higher levels of motivation and engagement in sport are not surprising considering that he is an "elite" athlete (Toering et al. 2009). This is consistent with previous findings on athletes' higher levels of effort in sport than in academic (McCardle et al., 2014). While he described trying to be "50/50" between sport and academics, he also mentioned that when there was a lack of time "your school work will be not that good for the most part as you could have done" (IV). He seemed to place more emphasis on improving his sport performance than improving his academic work and certainly reported spending more time engaged in sport. Athletes at a recreational level or at a lower competitive level than Camiel may place more emphasis on academics and therefore may demonstrate a pattern of more specific engagement of SRL processes in academics. Expert athletes demonstrate more sophisticated SRL processes than non-experts or novices (Kitsantas & Zimmerman 2002; Toering et al. 2009), suggesting competitive level of athletes may impact development of SRL and perhaps transfer of SRL between sports and other domains. The influence of competitive level on SRL between sports and academics warrants further research.

Moreover, research suggests SRL is related to performance (e.g., Cleary & Chen 2009; Zimmerman & Martinez-Pons 1986), implying better regulation means better performance. However, it is plausible that learners are regulating effectively, while not performing at the highest levels. For instance, Camiel feels he only has so much time to commit to academics and he engaged regulatory processes to make the most of that time. But it is plausible that Camiel is

Table 3  
Summary of Similarities and Differences in SRL by Theme

Theme	Role in SRL <sup>a</sup>	Similarities	Differences
Challenges	Challenge episodes are opportunities to adapt learning processes and indicate poor evaluation of progress.	Faced some challenges in both learning contexts.	Many, varied challenges in table tennis training, but few challenges in academics. Some challenges in sport were more specific than vague “getting started” challenges in academics.
Task understanding	Task perceptions lay the foundation for goal setting and strategy choice.	Evidenced breaking down tasks and prioritizing task elements. Also matched strategies to task at hand.	Very specific, technical descriptions of table tennis tasks, while academic descriptions were more vague. Coach played a role in helping Camiel understand technique.
Goal setting	Goals provide standards for evaluating progress and direction for choosing strategies.	Some specific standards in both.	Goals described as much more detailed in sport than in academics. Academic goals focused on completing tasks while sport goals focused on technical processes and guided by the coach.
Monitoring and evaluating	Metacognitive processes critical to knowing when progress is good or poor and guiding adaptations.	Used implicit, intuitive judgments in both sport and academics. Used external feedback to help evaluation in both contexts.	Constant and central to learning in sport, but struggled to describe monitoring in academics. Use of external feedback sources (e.g., coach and training partners) more in sport than in academics.
Adapting	Making changes in learning processes to succeed in reaching goals.	Evidenced making changes in priorities, focus or goals, and motivation strategy when needed in both contexts.	In sport, there was also evidence of adapting on a large scale by changing coaches and training centers.
Big picture		Some level of focus in both contexts beyond what was happening in today’s session.	Consistently described proactive efforts to make each table tennis practice focus on improving for matches and tournaments. Thinking beyond this study session in school was limited to deadlines and course topics and was in reaction to low motivation levels.
Metacognition		In both contexts, demonstrated an understanding of how learning unfolded effectively and some particular strengths and weaknesses as well as effective strategies.	More specific in sport about what his weaknesses were and how to progress learning so that best actions in table tennis were automatic.

a. For theory-driven themes and based on Winne and Hadwin’s (1998) model.

not regulating towards the goal of having a 10/10 GPA and in fact he mentions aiming to simply pass his exams. This suggests it is critical to take students' goals into account (Boekaerts 1995) as well as external contexts as a reference for what "successful" means in terms of regulating. Caution is needed when using GPA or other outcome measures as indicators of success. While it seems likely those with higher GPAs are productively self-regulating, it is possible learners are successfully regulating to lower goals such as getting 6/10. That is lack of externally defined success does not necessarily imply lack of regulation and points to the importance of SRL measures that ask about what learners' intended goals are and to qualitative methods that situate learning in context (Butler 2011).

The second noted difference between academic and sport contexts related to the role of his coach. Although Camiel did a fair amount of training on his own or with training partners, his coach played a critical role in guiding him. This was also a proactive decision: Camiel had purposely made the decision to change coaches in order to train with a coach he trusted. His coach helped him to develop his technical and tactical knowledge of table tennis and to evaluate his performances and guide his training and competition goals. In contrast, Camiel had little contact with his professors and felt that although his professors were available if he needed, there was little need to work with them. In academics, he was mostly left to his own devices to monitor his study progress and got feedback only very rarely when he wrote exams. In my experience, this reflects a typical difference between high-level sport, where athletes have closer relationships with their coaches, and university settings, where students have little contact with professors and where feedback is given only at rare intervals. Thus, there seem to be differences in the sport and academic contexts that may have implications for developing and supporting SRL.

The close role of Camiel's coach poses an interesting possibility: does a coach help guide an athlete in their self-regulation (i.e., co-regulate; Hadwin et al. 2011) or does a coach regulate for the athlete (i.e., other regulation)? That is, does the help of the coach guide an athlete's own SRL, or does it leave athletes relying on the coach to set goals, evaluate, and propose changes? In Camiel's case, although he worked closely with a coach, there was clear evidence that Camiel took responsibility for his training and was very active in monitoring his learning and making changes where necessary. Camiel's coach seemed to play a co-regulator role. More research is needed to address the differential roles of teachers and coaches as co- and other-regulators and the impact on both SRL in that domain and across domains.

The clear engagement of SRL processes in both academics and sports suggests there may be transfer of these processes from one to the other. Because he was more proactive in regulating in sport and had close guidance from his coach, it seems Camiel developed and more carefully applied SRL processes in sport. When asked to comment on the connection between his sport and academic learning, Camiel was certain sport had taught him much about learning that was applicable in his school learning. "From sports, you learn a lot, for example, discipline, making goals, but also learning how to learn because in sports you always try to improve and to learn" (IV). From his perspective, learning processes transferred mostly from sport to academic learning.

### **Concluding Thoughts**

In this research, I aimed to explore the SRL processes of a student-athlete in sport and academic contexts. Using Winne and Hadwin's (1998) model as a framework, I conducted a case study with Camiel, an international-level table tennis player enrolled in post-secondary education. This study has contributed to SRL theory by advancing investigation into transfer of

regulation across different learning contexts as well as by applying Winne and Hadwin's (1998) model to sport. This is the first time, to my knowledge, that Winne and Hadwin's (1998) model has been applied to the sport context. By breaking down tasks and prioritizing task elements, Camiel demonstrated detailed understanding of table tennis (Phase 1). He set specific goals to guide his focused (Phase 2) and engaged sport-specific tactics (Phase 3), such as particular drills for footwork. He consistently monitored and evaluated his performance and was careful to make changes and adapt when he faced challenges, whether technical or mental (Phase 4). Evidence of Camiel's engagement of each phase of SRL in his table tennis training suggests Winne and Hadwin's model, designed for solo academic studying, is useful for examining learning in sports.

As suggested by Butler (2011), case study methodology provided an appropriate method for investigating "SRL as a multi-componential, dynamic, recursive, and situated activity" (p. 358). The present use of case study design allowed for an understanding of how Camiel perceived his regulation in two different contexts and to examine similarities and differences in sport and academics. The analysis accounted for the context as well as the learner's perspective on two separate learning contexts. Further qualitative research on SRL is needed to better understand *how* learners regulate in dynamic situations and the relationships among SRL processes in these situations.

Case studies, however, are bound to the participant and this case study is no different; results of this case are specific to Camiel and his particular experiences in table tennis and university studying in his particular setting, although many parallels are evident in other sports and other national contexts. Camiel was chosen because he had demonstrated success in his sport and also demonstrated high levels of motivation in his sport. Other student-athletes may not demonstrate such high levels of motivation and deliberate engagement of regulatory processes. This high level of motivation, particularly in sport, may have influenced the degree to which he was willing to talk about his learning in each context. Additional case studies examining SRL in different sports and academic programs would further elucidate the similarities and differences in SRL across sport and academics.

The qualitative analysis was particularly interesting in relation to task understanding. Winne and Hadwin (1998) separate task understanding from goal setting, yet little qualitative research has focused on how learners understand tasks. In both contexts, evidence for Camiel's task understanding often came from asking about other areas, such as goal setting and monitoring. Being able to break a task down into specific goal elements and monitoring for particular movements were indirect indicators of task perceptions. Considering task understanding is the theoretical basis of regulatory actions, this is not surprising. Directly asking Camiel how he understood what to do often resulted in vague answers, suggesting that perhaps he was less metacognitively aware of this phase of learning.

Moreover, Camiel's tendency to talk about his learning at a macro level, even when focused on particular challenge episodes in the VSR, made it difficult to identify evidence of the COPES architecture (Winne 1997; Winne & Hadwin 1998) that occurs at a more micro level. Using microanalytic approaches (Cleary 2011) in both academic and sport tasks may elucidate the specific COPES processes around each phase of regulation.

The importance of SRL for performance in sport and academics suggests concurrent success in these domains is related to transfer of SRL across these contexts. Yet, how regulatory processes transfer across domains is important for all learners, not just student-athletes. If regulatory competencies developed in one domain cannot be adapted to new situations, teaching students to "learn how to learn" seems pointless. This case study provides a first step in

understanding how SRL processes are related across sport and academic contexts. Combined with evidence that learners apply metacognitive processes across different academic domains (e.g., Veenman & Spaans 2005), the present findings suggest learners use the same regulatory processes in different learning contexts and thus maybe able to draw on previous regulatory experiences to inform engagement of new regulatory processes. This points to potential for supporting learners by drawing on other learning domains, such as sport or music (e.g., McPherson & Renwick 2001, 2011), in which regulation might be more obvious. Although this paper represents one in-depth study with one student-athlete, the findings suggest transfer of SRL is an area worthy of continued investigation. Confronting the challenge of understanding transfer of SRL is necessary if SRL is espoused to be a critical 21<sup>st</sup> century learning process.

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**Appendix A**  
**Semi-Structured Interview Items**

<b>Theoretical Focus</b>	<b>Sports</b>	<b>Academics</b>
Rapport and Demographics	<p>How did you get involved in your sport?</p> <p>What's your favorite thing about your sport?</p> <p>How long have you been competing in your sport?</p> <p>What level of competition have you reached in your sport?</p> <p>What would you give as examples of your level of performance?</p> <p>How many hours a week are you training?</p>	<p>What year are you in and what is your major?</p> <p>How did you decide on your major?</p> <p>What's your favorite thing about your major?</p> <p>What kinds of grades do you get?</p> <p>What was your average last semester?</p> <p>What would you give as examples of your level of performance?</p> <p>How many hours a week do you focus on your studies?</p>
General Approach	Can you tell me a little bit about how you approach a specific practice session? In other words, walk me through a practice. What you do and what do you think about just before, during and after the training session?	Can you tell me a little bit about how you approach a specific study session? In other words, walk me through a study session. What you think about and do just before, during and after the study session?
Challenges	<p>What kinds of challenges do you feel you face in your training? Can you describe one or two of your challenges?</p> <p>When you are facing a challenge, what do you do to overcome that?</p>	<p>What kinds of challenges do you feel you face in your studying? Can you describe one or two of your challenges?</p> <p>When you are facing a challenge, what do you do to overcome that?</p>
Task Perceptions	<p>How do you figure out what is required to perform well?</p> <p>Who determines the standards for your performance in your sport? In a specific training session?</p>	<p>How do you figure out what is required to perform well?</p> <p>Who determines the standards for your performance in a course? In a study session?</p>
Goals	<p>How do you decide what you want to accomplish in a training session?</p> <p>Describe for me the way you use goals in training. Give me an example of a goal you have set for practice this week. Do you set an explicit goal for each practice? How detailed are the goals you set for a specific training session?</p>	<p>How do you decide what you want to accomplish in a study session?</p> <p>Describe for me the way you use goals in your studying. Give me an example of a goal you have set for studying this week.</p>

<b>Theoretical Focus</b>	<b>Sports</b>	<b>Academics</b>
Monitoring	<p>How do you monitor your performance during a specific training session or practice?</p> <p>What do you use to determine how well you are doing?</p> <p>How does feedback from your coach inform or change the way you monitor your performance?</p> <p>How do you decide when your training session is over?</p>	<p>How do you monitor your performance during a specific study session?</p> <p>What do you use to determine how well you are doing?</p> <p>How does feedback from your professors inform or change the way you monitor your performance?</p> <p>How do you decide when your study session is over?</p>
Specific example	<p>Give me a recent example of at time when you really encountered a challenge in your studying. How did you tackle that challenge?</p> <p>How did you adjust your studying during a specific session? How did you adjust your studying from one session to the next?</p> <p>How do peers influence how you approach and change your studying?</p>	<p>Give me a recent example of at time when you really encountered a challenge in your training. How did you tackle that challenge?</p> <p>How did you adjust your training during a specific practice? How did you adjust your training from one practice to the next?</p> <p>How do training partners or team members influence how you approach and change your training/practice?</p>
Connection	<p>Do you think your sport training and academic learning are connected in any way? Is this positive or negative or both?</p>	

**Appendix B**  
**Study and Training Journals**

<b>Items</b>	<b>Response Options</b>
Did you have a goal for today's studying/training or something you were trying to achieve?	Yes No
If yes, what was it?	Open
Did you reach your goal?	Not at all Somewhat Mostly Completely
Describe what you struggled with when trying to accomplish your goal.	Open
How did you know that you were having difficulty of that this was something you wanted to improve?	Open
Describe what you did to try to overcome that challenge.	Open
How helpful was that?	Not helpful at all Somewhat helpful Mostly helpful Very helpful
Is there anything you want to do differently next time?	Yes No
If yes, what?	Open