

Relationships Between Self-Regulated Learning, Deliberate Practice and the Consideration of
Future Consequences for Developing Sport Experts

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SELF-REGULATED LEARNING IN DEVELOPING ATHLETES

Abstract

This thesis explored relationships (1) between composite and constituent processes of self-regulated learning (SRL) and three sport performance groups, (2) between SRL and different practice variables, and (3) whether these associations depended on an athlete's consideration of future consequences (CFC). Athletes ($N = 272$; 200 males; 18-35 yrs; M practice = 13.55 hours/week) completed survey measures for SRL, weekly training including deliberate practice (DP), performance level and CFC. Higher scores in composite SRL were associated with a greater chance of belonging to an elite group, compared to a less-elite and a recreationally competitive group. Self-monitoring predicted greater likelihood of membership in less-elite and elite groups compared to the recreationally competitive group. Self-monitoring predicted greater engagement in total DP hours, and DP in supervised and unsupervised settings. Effort, self-efficacy, and planning were notable in some results, but contributions were less significant. CFC had no moderating effect, however it was correlated with SRL.

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Chapter 1: Introduction

Research identifying the factors that differentiate the extraordinary from ordinary performers gave rise to the academic domain of expertise, yet many questions still remain unanswered on the topic of expert sport development. Research on this topic can help us understand how best to guide developing experts and how to contribute to interventions and programs that effectively develop elite athletes (Toering, Jordet, & Ripegutu, 2013). Ericsson, Krampe and Tesch-Römer (1993) founded the main conceptual framework guiding the development of expertise with the theory of deliberate practice (DP). This framework states that the amounts of DP in which individuals engage are directly associated with their level of expertise, and there is support for this contention in sport (Starkes, 2000). Experts typically show an advantage in that they have been better able to, or perhaps been more motivated to accumulate more DP than their lesser-skilled peers. DP is a highly structured activity that demands effort, that has no immediate rewards, and that needs to be sustained over long time periods to attain higher levels of performance (Ericsson et al., 1993). It has been argued that those who become experts, unlike the vast majority of their peers, do so because they are involved in many years of dedication and persistence at DP, and, importantly, that they are better able to *self-regulate* to negotiate the struggles and diverse challenges that come with such DP (Zimmerman, 1998).

Self-regulation in a learning or practice environment involves processes such as planning, self-monitoring, evaluation, reflection, self-efficacy and effort (Zimmerman, 2006). It is believed that these processes, either individually, or collectively, allow athletes to control their thoughts, feelings, and actions, helping them override counterproductive behaviours during training (Toering et al., 2011). Therefore, the attainment of an elite level is associated with more than just natural abilities, it is also predicated on the quality and quantity of DP spent on the activity and

importantly, the quality and quantity of DP may depend on self-regulated learning capabilities in support of training. Recent literature proposes that self-regulated learning (SRL) processes may help maximize DP (Baker & Young, 2014). Indeed, a limited number of studies show that experts use more and better SRL processes than less-expert athletes, implying that athletes are more engaged in what they have learned and are more willing to invest effort into task execution (Kitsantas & Zimmerman, 2002; Toering, Elferink-Gemser, Jordet, & Visscher, 2009; Zimmerman, 2006). Despite these useful first steps, more research is needed to understand the nature of expert-novice athlete differences on aspects of SRL with respect to sport practice.

In addition, little research has looked at the different processes that explain why experts have an advantage in DP. Although SRL processes have been advanced as important psychological processes for navigating and maximizing DP, little research has examined how specific SRL skills directly relate to the amounts of DP. This study will determine which SRL processes would be most important for developing sport experts, as well as examine which SRL processes might be most important for overcoming barriers associated with DP. The specific aims of this study are to examine expert/novice differences in aspects of SRL, as well as to examine the relationship that various facets of SRL have with amounts of DP in sport.

Finally, little research has examined individual difference variables in relation to DP and how individual difference variables may make some individuals more prone to engage in SRL processes. Research shows that SRL is associated with more effective learning, yet the results of this enriched learning are not immediate (Zimmerman, 2006), and are delayed in nature (Côté, Baker, & Abernethy, 2003). One variable called Consideration of Future Consequences (CFC) has been shown to influence SRL towards long-term outcomes in non-sport achievement domains (Joireman, Strathman, & Balliet, 2006) and thus it may also be an interesting variable that has a

bearing on relationships between SRL and DP in sport. As CFC has not been studied in sport nor in reference to the DP framework, this study will explore whether CFC is a potential moderating variable of relationships between SRL and DP. Overall, results from the current investigation may give us some insights on whether facets of SRL are associated with how athletes maintain their motivation and effort towards DP.

Chapter 2: Review of Literature

The Role of Deliberate Practice in Expertise

The theory of DP (Ericsson et al., 1993) is the main framework guiding research on the development of expertise in achievement domains such as music, chess and sports. The main premise states that elite performance is directly related to the amount of domain-specific DP that an individual accumulates. Expert performance is slowly acquired over a long period as a result of cumulative DP, with the highest levels of performance appearing to require an extensive period of intense prior preparation (Ericsson et al., 1993). DP is defined as activities that have been found most effective in improving performance, specifically comprising goal-directed activities that tend to be effortful, not immediately motivating, nor enjoyable, with no immediate rewards (Ericsson et al., 1993). DP activities have also been characterized as involving conscious attempts by the learner to structure learning activities in specific ways to maximize the degree of skill acquisition – the structuring of activities involves deliberate cognitive processes related to planning, execution, and reflection (Ericsson, Prietula, & Cokely, 2007). These processes can be facilitated when a learner interacts with a coach, but Ericsson et al. (1993) made the case for the importance of such processes during practice alone. Moreover, for training to qualify as DP, athletes should also receive immediate instructive feedback and the results of their performance, which may involve generating self-feedback in relation to one's own learning activities (Ericsson et al., 2007).

According to Ericsson et al. (1993), the maximization of DP is constrained by effort and motivational factors. With respect to effort constraints, DP extends over an extensive period of training for experts and requires much available time and energy from the individual. Daily amounts of DP can only be sustained for so long as there are no benefits from durations

exceeding four hours per day and reduced benefits from DP amounts exceeding two hours a day (Ericsson et al.). If sustained for too long, it can lead to exhaustion; therefore, individuals must limit practice to an amount from which they can completely recover on a daily/weekly basis (Ericsson et al.).

As for motivational constraints, athletes need to be motivated to engage in the activity before they begin DP as it is neither inherently nor immediately motivating. In fact, Côté et al. (2003) defined DP as preparatory activities that could be distinguished from free play, deliberate play and structured practice, because its benefits were exclusively of a delayed nature, involving delayed gratification on the part of the athlete. One possible motivation that may drive DP is the athletes' belief that DP is essential in achieving further and future/delayed improvements in performance (Ericsson et al., 1993). This idea that aspiring athletes need to be motivated to practice because it leads to future improvements in performance is captured by Ericsson et al. (1993, p. 368), who stated: "engaging in deliberate practice generates no immediate monetary rewards and generates costs associated with access to teachers and training environments. Thus, an understanding of the long-term consequences of deliberate practice is important". In this instance, it is plausible that the understanding to which Ericsson et al. allude is a reference to the athletes' belief – athletes with a vision aimed towards the future may be able to justify the worth of current dedication to DP and may be able to better overcome the obstacles of hard work, physical fatigue and soreness in their more immediate sport training.

Expert/novice differences in terms of DP. Ericsson et al. (1993) found that the amount of time an individual is engaged in DP activities is proportionally related to that individual's acquired performance. One of the hallmarks of the expertise approach, including studies of sport expertise, is establishing expert-novice group differences for a phenomenon of interest (e.g.,

Kitsantas & Zimmerman, 2002). In order to establish the DP mechanism as an explanation for expert development, researchers did just that. Research in domains such as music (e.g., Ericsson et al.) and chess (e.g., Charness, Krampe, & Mayr, 1996) has confirmed that differences in performance between experts and novices are attributable to large differences in current and accumulated amounts of DP. Many studies in the sports domain have examined DP hours relating to expertise (e.g., Helsen, Starkes, & Hodges, 1998; Starkes, 2000) and have generally suggested that expert/novice differences are due to variations in accumulated hours of DP. Experts spend more time overall in training but they also spend more time in specific training activities that are most pertinent for the development of expert performance (Baker & Young, 2014; Young & Salmela, 2010). For example, Baker, Côté, and Abernethy (2003) found that expert players from basketball, netball and field hockey accumulated significantly more hours in organized team practices, one-on-one coach instruction, and video training, than less-expert players. Similarly, Deakin and Cobley (2003) found that elite figure skaters spent more time practicing the more advanced technical aspects of performance such as complex jumps and spins than less-elite figure skaters, who instead spent more time on already mastered skills.

This DP framework is highly nurturistic in its approach to understanding the development of very high level skills. This said, although extant sport research on the framework has not accentuated the notion of individual differences, there is some literature suggesting that certain individual difference variables may differentially predispose individuals towards DP. Ericsson et al. (1993) have acknowledged that “heritable individual differences might influence processes related to motivation and the original enjoyment of the activities in the domains and, even more important, affect the inevitable differences in the capacity to engage in hard work (deliberate practice)” (p. 399). In fact, there have been suggestions that individual differences in SRL

practices may help certain individuals maximize DP (Baker & Young, 2014; Young & Medic, 2008; Zimmerman, 1998). As such, the differences referred to by Ericsson et al. may in part be differences in SRL as well as differences in the understanding of the long-term consequences of DP. These individual differences may help us understand how athletes engage in inherently unenjoyable activities and how they prioritize certain activities over others. In light of this, the purpose of the current study is to identify individual differences in self-regulatory psychological processes that may be instrumental in motivating some athletes to practice more, or that may be key in facilitating processes that allow athletes engagement in greater amounts of DP.

Self-regulated Learning

The current investigation makes use of a social-cognitive framework of SRL (Zimmerman, 2006) to understand aspects of how athletes approach their sport practice. SRL is defined by Zimmerman (2008) as the degree to which “individuals are metacognitively, motivationally, and behaviourally active participants in their own learning process” (p. 167). Expert/novice SRL differences were first examined in other achievement fields such as academia (Zimmerman & Pons, 1986; also see Kitsantas, Winsler, & Huie, 2008; Nota, Soresi, & Zimmerman, 2004). In a sample of high school students, Zimmerman and Pons (1986) measured 14 different SRL processes in a naturalistic setting where 80 students were recruited from the advanced and lower achievement paths. Investigators found that the high achievement path displayed significantly greater use of 13 of the 14 SRL processes. In addition, the high achievement path yielded an increased prediction on standardized achievement test scores, controlling for gender and socioeconomic status. They were able to correctly classify 93% of the students in the appropriate path based on their use of SRL strategies (Zimmerman & Pons, 1986).

In view of this, we see the effectiveness and importance of using SRL strategies in a learning context.

The importance of SRL for DP in sport. A growing number of sport expertise researchers have advocated looking at Zimmerman's SRL model (or adaptations of it) as a template for understanding how athletes go about controlling their activities and motivation during DP (Jonker, Elferink-Gemser, & Visscher, 2010; Toering et al., 2009; Young & Medic, 2008; Young, Medic & Starkes, 2009; Zimmerman, 1998). Zimmerman (2008) pointed out that SRL refers to self-directed processes that allow learners to transform their mental abilities into performance skills. Hence, these processes may help individuals learn more effectively (Zimmerman, 2006) and, if executed with regularity, may help them regulate their own motivation and long-term goal striving efforts (Young & Medic, 2008). Self-regulated athletes regularly set goals, they systematically self-monitor by observing and tracking their own efforts, their performance, and outcomes of training, and are able to adapt when discrepancies are noticed between their desired and current states; therefore, athletes who self-regulate more effectively should be able to get more out of their training, and be more likely to reach their maximum potential (Toering et al., 2011). Self-regulated individuals also show personal initiative, perseverance, and adaptive skills because of well-disposed metacognitive strategies and motivational beliefs (Zimmerman, 2006, 2008). The development of expertise requires considerable amounts of DP involving hard work, fatigue, sometimes mundane conditions, and delayed rewards (Ericsson et al., 1993); this means that persistence at DP is unlikely to occur without significant motivation, regulation of that motivation to practice, and regulation of the constituent learning strategies that allow an aspiring athlete to get the most out of their practice.

According to Young and Medic (2008), developing athletes need to be motivated to practice on a near-daily basis over an extended period of time to attain expert levels of performance, necessitating intense and enduring persistence to their sport. As athletes develop, there tends to be less emphasis on reinforcement from coaches, hence athletes need to learn how to reinforce and regulate their own motivation and practices. In reviewing Zimmerman's (1998) cycle of SRL activities as they relate to sport, Young and Medic identified four key cyclic processes for which an athlete needs to take ownership to optimize their practice. These self-processes may be particularly relevant in the absence of a supervising coach and especially in individual sports. These self-processes included (1) goal-setting and strategic planning for practice to identify performance aspects/skills that need to be improved and how strategies can be implemented, (2) monitoring of strategy implementation in practice, to assure oneself that they have chosen the correct means, (3) monitoring of strategic outcomes in training, to identify whether these strategies are improving their performance and, (4) self-evaluation of training outcomes, to adjust their current behaviours in light of their outcomes. This last step can act as a reinforcement step or a readjustment of their current goals (Young & Medic, 2008).

Toering et al. (2009; see also Toering, Elferink-Gemser, Jonker, van Heuvelen, & Visscher, 2012) have begun work on SRL dispositions that may allow young athletes to train better. Following preliminary validation work on key SRL processes in sport (Toering et al., 2012), Toering et al. (2009) identified six key processes as planning, monitoring, evaluation, reflection, effort and self-efficacy, where self-efficacy and effort refer to the motivational aspects of SRL. These processes are pertinent to self-controlled cognitive aspects during an athlete's daily practice. Individuals engaging in SRL commit efforts to learn how to effectively control the duration and intensity of their behaviours across many training activities, while at the same time

copied with fatigue and injury and considering how their behaviours will help for the preparation of future performances (Young & Medic, 2008). By engaging in SRL, athletes are able to emphasize practice behaviours that they see as advantageous and disregard actions that they judge to be unproductive or detrimental to their practice (Young & Medic, 2008). They are able to gain information about their learning processes that can be used to change subsequent training goals, strategies or practice efforts (Baker & Young, 2014). Considering the aforementioned information and the value of SRL processes for practice, one might expect expert athletes to demonstrate a SRL advantage compared to their lesser skilled athletic peers; this hypothesis is pursued in the current study.

Expert/novice SRL differences in sport learning settings. A limited number of studies in sport or motor learning have explicitly examined expert/novice differences for SRL strategies (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002; Toering et al., 2009). Overall, results from this research show that expert athletes self-regulate their learning efforts and activities better than non-experts and novices.

In a study by Cleary and Zimmerman (2001), 43 male basketball players were recruited: 15 experts, 13 non-experts and 15 novices with a mean age of 16. They were asked about their forethought goals, strategy choice, self-efficacy, self-reflection attributions and feelings of satisfaction while they practiced their free-throw shooting during a training session. The examiners asked them oral questions relating to these variables before, during and/or after their free-throws. Group differences in SRL were confirmed by the fact that experts used better methods to self-regulate their learning. More specifically, experts set more specific goals, selected more technique-oriented strategies to achieve their goals, and displayed higher levels of self-efficacy than non-experts or novices. In addition, most experts (53%) gave specific

technique-oriented strategies when they missed their free-throws which reassured them that future performances could be improved, compared to only 15% of non-experts and 13% of novices. Investigators suggested that these findings allow experts to have an advantage over their non-expert and novice peers for improving and sustaining high levels of skill and motivation because it allows them to focus on essential components. In sum, experts displayed higher quality of SRL during self-directed practices than non-experts and novices (Cleary & Zimmerman, 2001).

Similarly, Kitsantas and Zimmerman (2002) assessed differences in the quality and quantity of SRL processes among expert, non-expert and novice volleyball players. Thirty women with a mean age of 20 participated, consisting of ten players in each performance group. Using a micro-analytic approach, specific oral questions relating to self-efficacy, intrinsic interest, perceived instrumentality, self-satisfaction, goal-setting, planning, strategy use, self-monitoring, self-evaluation, attribution and adaptation processes were asked at key points while players practiced their serve. Significant differences for SRL processes were found on all accounts between each of the groups. Specifically, experts displayed higher levels of forethought such as setting more specific techniques or process goals, had greater planning structure, higher levels of self-efficacy, and more interest in the intrinsic task properties as well as the perceived instrumentality of overhand serving than non-experts and novices. In addition, experts used more self-regulatory processes during their practice performance such as using more specific technique strategies, more SRL of their technique and more SRL of their outcome goals compared to other groups. Experts were also more likely to self-reflect on their serving performances, attribute failures to poor technique, and report higher levels of self-satisfaction. As for methods of adaptation, experts thought about their errors and were more likely to change their technique

accordingly, and were more proactive in help-seeking from others. Interestingly, investigators calculated a composite score representing overall use of these SRL processes. When this composite SRL score was correlated with volleyball server skill, it yielded a high correlation ($r = .95$), with a predicted variance of 90%.

Finally, Toering et al. (2009) recruited 444 youth males aged 11-17 who were classified as elite (national level) or non-elite (regional level) soccer players. They were given a self-report questionnaire (Self-Regulation of Learning Self-Report Scale; SRL-SRS) assessing 6 different SRL processes: planning, self-monitoring, evaluation, reflection, effort and self-efficacy. Results showed that elite youth soccer players reported higher SRL scores than non-elite players (Toering et al.). In particular, differences were found on two aspects of SRL: reflection and effort. Results from logistic regression analyses showed that players scoring high on reflection were 4.9 times as likely to belong in the elite group than players scoring low on reflection. The same trend was seen with effort, where players were 7.02 times as likely to belong in the elite group if they scored high in effort. This implied that elite youth players are more engaged in what they have learned, may be more aware of their strong and weak points and are better able to translate this awareness into action, and may be more willing to invest effort and persist with task execution (Toering et al.). These studies support the view that players who score high on self-assessed SRL may employ these processes in such a way as to benefit more from practice and to motivate themselves to do more practice, which may explain the differences in performance level.

Although the studies by Toering et al. (2009, 2012) have done significant work to advance the field of SRL in sport, Toering et al. (2009) also had limitations. First, only two skill groups were used to discriminate SRL processes, and objective performance standards were not used to reliably bin athletes into separate groups. Second, no composite SRL score was considered and

therefore no comparisons were made to see how the contribution of composite SRL may differ from constituent SRL processes. Third, the full variability of the SRL data was not used in analyses, as data was fractured into low, medium and high groupings. Lastly, although it has been validated with Dutch adolescents, no research has examined the scale with North American athletes. As a dispositional measure, it has been employed in academic contexts as well as in sport (McCardle, 2015). However, researchers have advocated for more domain-specific assessment of SRL measures in sport (Baker & Young, 2014). Therefore, one of the purposes of this thesis was to vet the face validity of the SRL-SRS to determine whether any minor modifications are required for its use as a sport-domain instrument. In addition, we aimed to examine the factor structure of the SRL-SRS of any refined version of the SRL-SRS specifically within a North American athletic sample.

In sum, the above studies confirmed how various SRL processes differentiate experts versus less-expert athletic groups. The current investigation also aimed to distinguish expert versus less expert groups, but based on *composite* SRL, or *overall* SRL scores. We sought to additionally examine *specific* SRL processes as Toering et al. (2009) did. However, whereas Toering et al. (2009) used two performance groups, the current study planned to use three different performance groups for better discrimination. Thus, the current study examined which of the six SRL processes advocated by Toering et al. significantly differentiate expert and less expert athletic groups, and whether some processes are more critical than others. It is also notable that none of the aforementioned studies looked at how SRL processes actually predict the amount of DP that athletes engage in. For example, although Toering et al.'s results implied that elite youth players are more engaged in what they have learned and are more willing to invest effort and persist with task execution, no association was made to greater amounts of quality DP for

these elite athletes, compared to less elite athletes. Therefore, another main purpose of this study was to determine the relationship between composite (overall) scores of SRL and overall amounts of DP. Furthermore, this study examined whether specific SRL processes from Toering et al.'s SRL-SRS questionnaire explain significant amounts of variance in DP, and whether certain SRL processes do this more strongly than others.

Consideration of Future Consequences

Other variables may also be considered for understanding engagement in effective and regular SRL and the maximization of DP. One possible variable that has been hinted at in the literature (Barone, Maddux, & Snyder, 1997; Ericsson et al., 1993) is *consideration of future consequences*: an individual difference variable that refers to the extent that people consider and are influenced by the distal outcomes of their behaviour (Joireman et al., 2006). The extent to which individuals consider the future implications of their current actions can have a significant impact on their current behavioural choices and, eventually, future outcomes.

CFC has been most widely regarded as a unidimensional construct where at one end of the continuum are individuals who consider the future outcomes of their current behaviours, whereas, on the other end, are individuals who do not consider possible future consequences (Joireman et al., 2006). Those high in CFC believe that certain behaviours are meaningful because of future benefits, even if immediate outcomes are undesirable, and are willing to sacrifice immediate benefits like pleasure to achieve more desirable future goals. On the other hand, some individuals are more concerned with maximizing immediate benefits (i.e., low CFC) at the expense of costs or benefits that will not happen for a long time. This may be because they are more strongly influenced by the relatively more concrete and immediate consequences than by uncertain future outcomes (Strathman, Gleicher, Boninger, & Edwards, 1994).

Studies indicate that individual differences in CFC predict a range of behaviours reflective of self-control and SRL. High levels of CFC are positively correlated with other indicators of effective self-control, including conscientiousness and delay of gratification (Strathman et al., 1994) and negatively correlated with impulsivity (Joireman, Anderson, & Strathman, 2003), which is a correlate of ineffective SRL. Higher CFC has also been associated with better SRL, and more adaptive outcomes in academic achievement (Joireman, 1999) and exercise domains (Joireman, Shaffer, Balliet, & Strathman, 2012). In two samples of undergraduate students, Joireman (1999) found that CFC scores were positively correlated with grade point average. He also found that CFC scores were positively correlated with scores on examinations and quizzes. Finally, CFC scores were positively correlated to goal attainment. In the exercise domain, in a sample of 259 active adults, Woodgate (2005) found CFC to be a significant moderator of the relationship between various indices of self-regulatory efficacy and exercise attendance. In addition, higher CFC was associated with greater efficacy in scheduling, goal-setting, barrier and relapse prevention and exercise attendance compared to exercisers with moderate CFC.

No research has examined CFC in the sport domain. To our knowledge, only one academic work has suggested that CFC, as an individual difference, can differentiate people's ability to self-regulate in the development of sport expertise and the proposition appears highly suited to the DP framework. Barone et al. (1997) stated:

Effective self-regulation depends on the ability and willingness to endure discomfort or deprivation here and now for some future and greater gain. . . . Sometimes, these short-term discomforts or sacrifices must be endured over a long period of time, such as in the training programs of Olympic athletes . . . Most of us would not view swimming laps in a pool, running endless laps around the track . . . as fun and those who engage in these

activities may also not view them as fun; yet, the research on hope, flow, and life tasks suggests that we may see these activities as rewarding and even enjoyable if we see them linked to important goals. Clearly some people are better at this than others...the disciplined practicers and rehearsers, whether they are Olympic athletes or concert pianists (p. 301).

CFC as a bi-dimensional construct. More recently, there has been a shift in the way CFC has been regarded with multiple studies providing support for a two factor CFC model: CFC- Future (CFC-F) and CFC-Immediate (CFC-I; Arnock, Milfont, & Nicol, 2014; Joireman, Kees, & Sprott, 2010; Petrocelli, 2003; Rappange, Brouwer, & van Exel, 2009). CFC-I refers to the extent that individuals consider the immediate consequences of their behaviours whereas CFC-F is the extent to which they consider the future consequences of their behaviours. By separating the future and immediate items, one is able to tease apart these differences helping to get a better understanding of the relationship between CFC and outcomes of interest (Joireman et al., 2012).

Research shows there are distinctions between CFC-I and CFC-F as they relate to exercising behaviours. In a sample of 55 undergraduate students, exercising behaviours were predicted by CFC-F, rather than CFC-I (van Beek et al., 2013). Furthermore, CFC-F was related to healthier behaviours whereas CFC-I was related to unhealthier behaviours. Similarly, in a sample of 252 university students, it was shown that a promotion orientation (i.e., an orientation that facilitates achieving ideal goals by focusing on achieving positive outcomes) mediated the relationship between CFC-F and its relationship with exercise attitudes and intentions, but did not do so for CFC-I (Joireman et al., 2012).

The importance of CFC to SRL and DP. No studies pertaining to CFC have been examined in the sport domain, but justified our examination of this variable as it pertains to DP and SRL as follows. Athletes higher in CFC-F may be able to connect long term outcomes (e.g., being a high level athlete) to their current behaviours in such a way to better plan, monitor, evaluate, reflect upon, give task effort, and maintain efficacy toward their immediate DP. That is, higher CFC-F athletes may be more inclined to stay engaged in and persistent at their DP now. In contrast, athletes lower in CFC-F might be more prone to give up when DP conditions get hard, because they cannot rely on the resiliency that comes with being able to connect their current efforts to the rewards that will come at a much later time. This may particularly be the case when one considers how the physiological benefits that arise from training in sport may not occur for several weeks following training (Bompa & Haff, 2009) and that performance outcomes are latent and typically achieved only after several months of DP (Young & Medic, 2008). Not only are these outcomes latent but also uncertain and one must have faith that the effort put in now will result in these outcomes. Hence, people who have resilient faith (high CFC-F) and who can temporally project to these outcomes may be more likely to use more effective SRL strategies to achieve one's goals. Accordingly, it may be difficult for low CFC-F athletes to remain motivated, and presently engaged in effective SRL processes when desired/gratifying outcomes are delayed (Zimmerman, 2006) and uncertain in nature. That is, if individuals consider the future, rather than immediate, consequences of their actions, they are more likely to persist with demanding activities such as DP and engage in various processes of SRL.

Chapter 3: Overview of the Studies

Research Questions

The purposes of this study were five-fold. First, to vet the face validity of the SRL-SRS and make minor modification for a domain-specific measure and subsequently examine the factor structure of the refined SRL-SRS instrument in a North American athletic sample. Second, to examine (a) how composite SRL score predicts the likelihood of attainment in three groups of progressively skilled athletes and (b) how six constituent SRL processes predict the likelihood of membership in these same skill groups. Third, this study examined how composite SRL scores predicted the amount of sport practice (DP and other forms of physical practice) that an athlete engages in. Fourth, it determined specifically, which of six SRL processes best predicted amounts of sport practice. Finally, this study explored whether the influence of SRL on sport practice depends on individual differences in CFC-F and CFC-I.

Significance of the Study

We proposed that by answering these research questions, we would start to bridge the gap in the literature in terms of relating SRL to sport expertise, and SRL to DP in sport. This study attempted to replicate Toering et al.'s (2009) study on expert/novice differences with three different athletic groups, thereby providing more discrimination for the possible associations of SRL processes with attained performance levels. The current study represented only the fourth attempt to validate expert-novice differences with respect to SRL processes and sport practice. The establishment of expert-differences is important for advancing SRL as a facet of long-term expert development in sport. Importantly, this was one of the few studies that attempted to directly predict amounts of DP from both composite and specific SRL variables. It was our hope

that results could start to pave the way to consider SRL practices as an important variable in regards to the DP framework.

Understanding the effects of overall and specific SRL processes has important practical implications for athletes, coaches, training director and training curriculum designers. The results of this thesis could determine which specific SRL processes would be most important for developing experts, thereby indicating which processes should be focused on. In addition, findings could determine which SRL processes might be important for overcoming the barriers associated with DP, and which processes should be attended to in order to maximize DP. By contrasting composite with specific SRL processes, we aimed to determine if expert athletes generally engage in more overall SRL or if a tendency to focus on specific processes is a distinguishing factor of experts. Coaches and director programs would be able to appraise these findings to apply them to their coaching or curriculum designs for how best to manage their time in respect to athletes' reflection on practice efforts.

The current results could be important for preliminarily establishing whether CFC, as an individual difference variable, might be suitably applied to understand practice efforts in the sport expertise domain. As CFC is positioned as a dispositional variable (Strathman et al., 1994), significant results may suggest that CFC could be a legitimate screening measure when searching for individuals who may persist best at hard practice. If CFC were to be a significant moderator of the relationship between SRL and DP, this may suggest that more attention be given to better determine the different CFC orientations that make individuals prone to dedicate time to their sport and the development of expertise which may be helpful for sport scouts in their screening of athletes.

Methodology

Participants. 272 North American athletes from varying levels of competitive sport were recruited for this study (200 male, 72 female; ages 18-35, $M_{\text{age}} = 22.43$, $SD = 3.95$; M sport activity = 13.55 hours/week, $SD = 7.57$; range: 1 – 44 hours/week). Recruitment was done through cross-country and swimming events, via email to organizational representatives at sporting clubs and teams around Canada and through social media (see Appendices A-E). Participants were mainly recruited from two different individual sports: track and field (87%) and swimming (8%). Another 5% of our sample listed other individual sports as their main sport such as cycling and Nordic skiing. This allowed us to request standardized and objective measures of performance from participants on a within-sport basis, which we used to identify the level of expertise of our participants and took steps to bin our participants into groups reflecting three progressive performance levels. An emphasis in recruitment was placed on swimming and track and field because they have highly standardized public standards of performance that can be used to take steps to ensure proper validity and reliability.

To maximize participant recruitment, two methods were used: on-site and online surveys. For on-site recruitment, handouts were distributed at sporting venues and competitions which included the survey website's URL and an invitation to complete the survey. For online recruitment, emails were additionally sent to organizational representatives/coaches explaining the study and asking them to forward the link to our online survey to their athletes so they could fill it out at their convenience. Additionally, online recruitment was also done via social media, such as track and field/running websites and forums. Given the online nature of the web-based survey, participants were afforded the opportunity to complete the survey in a location of their choosing. Prior to recruitment, ethics approval was granted from the University of Ottawa

Research and Ethics Board (see Appendix F) and informed consent from pertinent organizational representatives (e.g., various competitive sport clubs and university teams) was obtained.

Survey measures. Participants were asked to complete five different questionnaire segments including: general demographic questions; questions pertaining to performance level; a questionnaire assessing athletes weekly practice activity (Hopwood, 2013); the Consideration of Future Consequences 14-Scale (CFC-14; Joireman et al., 2012); and a version of the SRL-SRS survey based on Toering and colleagues' (2012) prior work.

Demographics. General questions (see Appendix G) were inquired such as full name, sex, date of birth, current city, their primary sport, and number of years involved in this sport from when they started to train regularly and compete, as well as whether they are currently training and competing.

Performance level. Performance level (see Appendix H) was inquired in two ways. First, participants were asked about the highest level of representation they have achieved in their lifetime as a junior athlete, in their lifetime as a senior athlete, and their current performance level as a senior athlete. Response options were local, city, regional, provincial/state, national and international. Secondly, they were asked to accurately report (1) their best competitive performance ever and (2) their best competitive performance in the past 12 months, whether it be in minutes and seconds or meters and centimeters in an event (e.g., 100 meters, freestyle) in their primary sport. They were asked to provide the name of the competition where this mark was achieved, as well as the month and year when they achieved this result. These questions allowed us to verify the reliability of the results that were provided.

Amounts of weekly practice activity. This segment was based on Hopwood's (2013) approach for obtaining data in several preparatory activities for one's primary sport. The

questionnaire (see Appendix I) was prefaced to prompt participants to report amounts for a “typical week” during one’s training season, with specific reference to a week during the competitive season of their main sport that is 10 weeks prior to their major competition. Athletes were prompted to give hours per week in *sport-specific practice* for their main sport in the following four conditions: (1) where a coach is present providing supervision to you and others, (2) a coach is present providing one-on-one supervision only to you, (3) no coach is present to provide supervision but you are practicing with others, (4) no coach is present to provide supervision but you are practicing on your own. Questions for weekly practice for these same four conditions were also asked for *physical preparatory activities* described as activities aimed at improving physiological and muscular capacities such as strength, power, endurance, and flexibility (e.g., strength and conditioning, weights, fitness, pilates, yoga, and flexibility training; Hopwood, 2013).

Participants were encouraged to use any information that helped them with recall (e.g., training logs, online result archives) to ensure greater reliability. A question verifying the method of recall was also asked.

The SRL-SRS. We planned to use this 46-item questionnaire (see Table 1, Manuscript 1, this thesis) which is divided into 6 sub-scales including planning, self-monitoring, evaluation, reflection, effort and self-efficacy. Participants were asked to respond to the items as they relate to solving problems and executing tasks. Likert-scale items were anchored at 1- ‘Almost Never’ and 4 - ‘Almost Always’; exceptionally, the evaluation items were anchored at 1- ‘Never’ and 5- ‘Always’ and reflection items were anchored at 1- ‘Strongly Agree’ to 5 - ‘Strongly Disagree’.

Planning refers to the respondent’s awareness of the task demands prior to its execution. Self-monitoring is the deliberate tracking of some aspect of one’s behaviour during practice

activities. Evaluation refers to double checking throughout the entire process to evaluate if the task is being done correctly. The fourth subscale is reflection, which is the questioning of one's experiences in light of what is being learned. Effort is defined as willingness to attain the task goal. Finally, self-efficacy refers to how an individual judges his or her capability to organize and execute required actions.

As Toering et al. (2009) intended, athletes' scores on respective items for each of the six scales were averaged to derive six constituent SRL mean scores. Moreover, in the current thesis, we elected to derive a composite SRL score, which was calculated by averaging together the scores of each subscale whereby equal weight was given to each subscale. We planned to first submit these original items from Toering et al. (2012) SRL-SRS to analyses of face validity involving independent reviewers in the domain of self-regulation. It was expected that comments and suggested revisions from this face validity vetting would be essential in making minor refinements to aspects of the SRL-SRS to ensure it was sufficiently pertinent to sport and particularly a competitive sport training setting.

CFC-14 scale. Fourteen items (Joireman et al., 2012) were used to assess the extent to which participants consider their current behaviour with respect to distant outcomes, or more immediate outcomes (see Appendix K). This newer CFC 14-scale questionnaire was chosen over the original CFC scale as it has two additional future oriented items giving an equal amount of questions assessing both CFC-I and CFC-F factors. Items 1, 2, 6, 7, 8, 13 and 14 assess the CFC-F factor, which is defined as the extent that an individual considers the future consequences of their actions. Items 3, 4, 5, 9, 10, 11 and 12 assess the CFC-I factor, which is the extent that an individual considers the immediate consequences of their actions. Participants responded to questions on a 1-7 Likert scale anchored at 1 – 'not at all like me' and 7 – 'very much like me'.

Data Analysis

Preliminary analyses. First, participants were asked to provide us with enough information such as when and where, as well as the event in which they achieved their best performance for the purpose of verifying these results by checking the appropriate online archived results for our sample to see if the performance results were reliably recalled. Secondly, to ensure better recall validity for performance results, athletes were asked to use training logs, online archived results or any other method that could be used to ensure better recall. We then proceeded to separate our athletes into three different skill groups. To achieve this, multiple steps were taken to ensure discriminant validity in order to bin our participants into different performance groups.

Data analyses were conducted using the Statistical Package for Social Sciences (SPSS Inc., 2013), version 22. Descriptive statistics were performed on data obtained from our general demographic questions. The number of male/female athletes, the number of athletes in each sport, the mean age of our athletes, the mean of all three groups for the number of hours of DP per week and the number of years they have been training regularly in the sport were calculated. Outliers were examined in the distributions of all interval variables. Missing data were filled with an imputation regression (Fields, 2005).

Following our vetting of the original SRL-SRS survey items and an appraisal of their face validity with respect to sport, we planned to make any minor refinements and then submit the new items to factor analyses. Specifically, the factor structure and internal consistency reliability of the constituent SRL-SRS scales was examined in SPSS and AMOS.

Analyses to explain expertise. Our first set of analyses entailed four separate logistic regressions to predict the likelihood of an athlete being in each of two progressively skilled

performance groups, relative to a least-skilled performance group. First, scores from the SRL-SRS were treated as a composite score. Since each of the six constituent variables on the SRL-SRS carry the same weight, each variable was averaged. These six mean scores were then averaged together to create a composite SRL score. Using this composite score as an (interval) independent variable, a multinomial logistic regression examined the likelihood of belonging to each of the increasingly skilled performance groups. Secondly, a binominal logistic regression was performed to inspect differences between two higher performance groups on composite SRL.

Next, a similar approach to analyses was taken using the constituent SRL-SRS variables as independent predictors. A simultaneous logistic regression was performed using the six independent SRL constituent variables to identify the SRL processes that are associated with being in the increasingly elite performance groups. The odds ratio associated with each constituent SRL variable explained how much more likely athletes are to belong to a more-elite group if they were to engage in a particular constituent SRL process. Next, a binomial logistic regression was conducted to inspect differences in the constituent SRL processes between the two more skilled groups.

Analyses to explain DP. Linear regressions were conducted to determine (a) whether an athlete's composite SRL score, as well as (b) their scores for each of the six constituent SRL processes would predict the amount of total weekly sport practice in which the athlete engages, across all contexts. In addition, we tested to see if regression results would differ based on practice context: supervised, unsupervised, social and non-social by conducting additional linear regressions for (a) composite SRL and (b) constituent SRL processes for sport practice hours. Significant standardized beta weights in each of the regressions informed us the degree to which our composite SRL score, or each of the six SRL processes, affects DP.

Analyses to assess interactions with CFC. In order to examine how CFC influences relationships between SRL and DP, we planned to first examine the factor structure and reliability of the constituent CFC scales (CFC-F and CFC-I) to ensure confidence in the two scales. This was important considering that this new scale has never been used before in a sport sample. To evaluate the nature of the CFC constructs, we used AMOS software to inspect confirmatory factor analysis (CFA) indices for a measurement model representing the two factors from the CFC 14-scale (Tabachnick & Fidell, 2013). Cronbach's alpha values were computed to verify the internal consistency reliability of the two scales, to ensure that values were greater than .70 (Kline, 2000).

To determine if the influence of composite, as well as the specific SRL processes, on variance in DP depends on an individual difference of CFC, a series of moderating analyses was performed for both CFC-F and CFC-I using hierarchical regression analyses. Moderating analyses were performed with the PROCESS macro and proceeded according to guidelines from Cohen, Cohen, West and Aiken (2003; also see Tabachnick & Fidell, 2013). This type of hierarchical analysis was conducted to determine whether CFC-F and CFC-I, separately, moderate relationships between SRL and DP established in earlier analyses. These analyses were performed to examine moderation by CFC-F on the relationships between composite SRL and DP, and moderation by CFC-F on associations between constituent SRL variables and DP. The same analyses were conducted to assess moderation by CFC-I on the relationships between composite SRL and DP, and moderation by CFC-I on associations between constituent SRL variables and DP. The objective of these analyses was to show whether the contribution of composite and specific SRL processes are dependent on a type of CFC.

Hypotheses

Generally, we posited that athletes scoring higher on composite SRL as well as specific SRL processes would be more likely to be part of the more skilled performance groups, and specifically, the most elite group. As for specific SRL processes, we expected that more expert athletes would score higher specifically on effort and reflection, than the other groups; this hypothesis reflects Toering et al.'s (2009) expert-novice findings, though we expected that there might be other significant SRL variables predicting group differences for which we could inspect respective effect sizes. We also hypothesized that athletes higher in composite and specific SRL processes will have higher amounts of DP compared to those that score lower. Due to the exploratory nature of these analyses, hypotheses pertaining to specific SRL processes were not advanced. However, based on research in exercise domains (Joireman et al., 2012; van Beek et al., 2013), we proposed that CFC may moderate certain relationships: first, that athletes high on CFC-F would have a stronger relationship between their composite SRL score and DP, than athletes low on CFC-F; second, that athletes high on CFC-I would have a weaker relationship between their composite SRL score and DP.

Outline of Presentation of Results

To address the study's research questions, Manuscript 1 entitled: *Self-Regulated Learning in Developing Sport Experts* addresses the vetting of SRL-SRS survey items and appraisal of the face validity, refinements and factor structure analysis. In addition, it also addresses the application of data from these scales to examine how SRL predicts the likelihood of membership in skill groups.

Chapter 4 follows, reporting on analyses to explain sport practice. This chapter examines the relationship of composite and constituent SRL processes with DP. Following, Chapter 5

addresses the factor structure of the CFC-14 scale. In addition, it also reports on the moderating effect of CFC on the relationship between SRL and DP. The general discussion follows as the final chapter (Chapter 6) with an overview of all three studies, and addresses methodological and conceptual consideration, as well as practical implications of the studies.

Manuscript for Study 1: Self-Regulated Learning in Developing Sport Experts

Self-Regulated Learning in Developing Sport Experts

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Abstract

Self-regulated learning (SRL) likely plays a crucial role in expert development by helping individuals optimize their practice (Zimmerman, 2006). However, limited sport studies have examined expert/novice SRL differences in SRL, and almost none have used a self-assessed SRL measure. Therefore, the purpose of this study was to examine SRL differences in three progressively skilled athletic groups (recreationally competitive, less-elite, elite). We vetted the Self-Regulation of Learning Self-Report Scale (SRL-SRS; Toering et al., 2012) survey for face validity with an expert panel. 272 participants (200 m, 72 f; ages 18-35) completed the refined SRL-SRS and subsequent refinements for factorial validity were made. Participants also completed a weekly practice measure and performance level measure. Logistic regression analyses served to determine: a) how composite SRL processes, and b) how six constituent SRL processes, explain performance level membership. Results revealed that greater overall engagement in composite SRL was associated with being in the elite group compared to less-elite ($p < .01$) and recreationally competitive groups ($p < .01$). Of the constituent SRL processes, only self-monitoring predicted membership in the elite ($p < .01$) and less-elite group ($p < .01$) compared to the recreationally competitive. Findings suggest that elite athletes self-monitor more frequently and better integrate other SRL processes within a SRL cycle.

Key words: self-regulated learning, expertise, SRL-SRS, self-monitoring, sports

Self-Regulated Learning in Developing Sport Experts

The main framework guiding research on expertise development in achievement domains such as music, chess and sports is the theory of deliberate practice (DP; Ericsson, Krampe, Tesch-Römer, 1993). It states that elite performance is directly associated with the amount of domain specific DP that an individual accumulates. Establishing skill group differences for a phenomenon of interest is one of the hallmarks of studies of sport expertise. Experts tend to spend more time in DP than less-skilled performance groups (Baker & Young, 2014). Often, experts spend more time in DP in the absence of external support from a coach (Ericsson & Charness, 1994), which suggests that expert athletes may need to exercise higher levels of self-regulation (Zimmerman, 2006).

There have been suggestions that differences in self-regulation in a learning context help certain individuals maximize practice (Baker & Young, 2014; Elferink-Gemser, et al., 2015; Young & Medic, 2008; Zimmerman, 1998). Self-regulated learning (SRL) involves processes such as planning, self-monitoring, evaluation, reflection, effort and self-efficacy (Toering, et al., 2012). These processes, either individually (constituent SRL processes), or collectively (composite SRL), allow athletes to metacognitively, motivationally, and behaviourally be active participants in their own learning process (Zimmerman, 2008). Despite first useful steps, more research is needed to understand the nature of expert-novice athlete differences on aspects of SRL with respect to sport practice.

Several studies have used Zimmerman's (1998) SRL model to understand how athletes control their behaviours and motivation during training (Jonker, Elferink-Gemser, & Visscher, 2010; Toering et al., 2009; Young, Medic & Starkes, 2009; Zimmerman). In appraising this SRL model in sport, Young and Medic (2008) specified four key cyclic processes that an athlete needs

to optimize practice behaviours, which may be particularly relevant in the absence of a supervising coach and especially in individual sports. These processes include (1) goal-setting and strategic planning for practice to identify performance aspects/skills that need to be improved and how strategies can be implemented, (2) monitoring of strategy implementation, to ensure that one has chosen the correct means, (3) monitoring of strategic outcomes in training, to identify whether strategies are effective and, (4) self-evaluation of training outcomes, to adjust one's current behaviours in light of outcomes. This last process can act as a reinforcement step or a readjustment of current goals (Young & Medic, 2008). Conceptually, these processes are pertinent to self-controlled cognitive aspects during an athlete's daily practice.

In addition to cognitive aspects, self-regulated learning involves motivational aspects, which relate to effort and self-efficacy (Ericsson et al., 1993). Maximal efforts to improve, work hard on a task, and persevere, are necessary and must be maintained over several years (Ericsson et al.). Self-efficacy beliefs, representing the extent an individual feels competent when faced with difficulties, determine the goals individuals set for themselves, how much effort they expend, and their resilience to failure (Bandura, 1986). By engaging in SRL, athletes are able to gain information about their learning processes that can be used to change subsequent training goals, strategies or practice efforts (Baker & Young, 2014). Additionally, athletes are able to emphasize practice behaviours that they see as beneficial and disregard actions that they judge to be detrimental (Young & Medic, 2008).

Expertise may be associated with more than just practice quantity; it may also be based on quality practice that is associated with athletes' SRL processes during practice (Tedesqui & Young, 2015). It follows that expert athletes might be expected to demonstrate a SRL advantage

compared to their lesser skilled counterparts; very little research has pursued this hypothesis, which is the over-riding purpose of the current study.

A limited number of studies show that experts employ SRL processes more frequently than less-expert athletes. Cleary and Zimmerman (2001) asked three progressively skilled groups of basketball players ($M_{\text{age}} = 16$) about their SRL strategies while they practiced their free-throw shooting. Group differences in SRL were confirmed as experts used better methods of SRL by setting more specific goals, selecting more technique-oriented strategies to achieve their goals, and displaying higher levels of self-efficacy than non-experts or novices. Kitsantas and Zimmerman (2002) assessed differences in the quality and quantity of SRL processes among expert, non-expert and novice volleyball players ($M_{\text{age}} = 20$). Experts displayed higher levels of forethought such as setting more specific technique or process goals, had greater planning structure and higher levels of self-efficacy before, during and after free-throws. In addition, experts demonstrated more SRL of their technique and outcomes, and were more likely to reflect on their performances, than other groups. Interestingly, investigators calculated a composite score representing overall use of SRL processes by combining 12 self-regulatory measures into a single scale to predict players' volleyball serving skill score. This composite SRL score yielded a very high correlation ($r = .95$) with volleyball serving skill, explaining 90% of variance. Like Zimmerman and Kitsantas, the current study examines specific SRL processes but also uses a composite SRL score to better understand their contributions to sport expertise.

Only one study has examined SRL in sport using a survey to examine expert/novice differences. Toering et al. (2009) recruited elite (national level) and non-elite (regional level) male youth soccer players to complete the Self-Regulation of Learning Self-Report Scale (SRL-SRS) which assesses six different SRL processes: planning, self-monitoring, evaluation,

reflection, effort and self-efficacy. Elite youth soccer players reported higher SRL scores than non-elite players. Differences were found on two particular aspects of SRL: reflection and effort. Logistic regression analyses showed that, players scoring high on reflection were 4.9 times as likely to belong in the elite group than players scoring low on reflection. The same trend was seen with effort, where players were 7.02 times as likely to belong in the elite group if they scored high in effort. This implied that elite youth players are more engaged in what they have learned and are more willing to invest effort and persist with task execution (Toering et al., 2009). Similarly, our study will use logistic regressions to determine membership in increasingly skilled groups using the same constituent SRL processes advocated by Toering and colleagues.

Although Toering et al. (2009) extended previous research, the study had certain limitations. First, only two skill groups were used to discriminate SRL processes, and objective performance standards were not used to validate the skill groupings. Second, composite SRL scores were not considered meaning no comparisons were made to see how composite SRL may differ from constituent processes. Lastly, the full variability of data for SRL processes was not used in analyses, because data were fractured into low, medium and high groupings.

The SRL-SRS used by Toering et al. (2009) is a dispositional self-regulated learning questionnaire used in sport and various domains. However, there are concerns that the SRL-SRS may not have face validity in the sport training domain and may not be tailored to sport. Toering et al. (2012) had advocated for the use of the SRL-SRS in specific sport domains, yet they had equally employed the scale in a generalizable fashion across sport and academic contexts (Jonker et al., 2010; also see McCardle, 2015). Evidently, this can be seen as problematic because it suggests that it is not a domain specific measure.

The purpose of this study was three-fold. The first purpose was to vet the face validity of items in the SRL-SRS in consideration of any minor modifications that might be made to ensure its suitability in a sport training context. Subsequently, we aimed to inspect the factor structure of the SRL-SRS in a North-American adult individual sport sample. The second purpose was to examine whether *composite* SRL scores derived from the SRL-SRS would distinguish between progressively skilled athletics groups. Third, this study aimed to identify the nature by which Toering et al.'s (2009) six constituent SRL processes would differentiate athletes' status in elite and less-elite athletic groups.

Methods

Participants

272 North American individual sport athletes (200 male, 72 female; ages 18-35, $M_{\text{age}} = 22.43$, $SD = 3.95$) participated in this study. Participants were from athletics (e.g. cross country, track and field, road running; 87%) and swimming (8%), with the remainder from a host of other individual sports (e.g., nordic ski, cycling). Athletes of all performance levels were recruited through cross-country and swimming events, via email to organizational representatives at sporting clubs and teams around Canada and through social media. Each participant gave informed consent and voluntarily partook in this research, which had received ethics certification at the host university. Each participant was currently training for competition and/or reported a competitive performance mark in the past 12 months for their main sport. On average, athletes reported 13.55 hrs/wk ($SD = 7.57$; range: 1 – 44; See Table 4) of sport activity for a typical in-season training week and had been regularly training and competing for 7.15 yrs ($SD = 3.90$).

Survey Measures

The questionnaire included four segments: general demographic questions; questions about performance level; Toering et al.'s (2012) SRL-SRS survey; and questions documenting amounts of sport practice.

Performance level. First, participants were asked about the highest level of representation they had achieved in their lifetime as a senior athlete (18 and older), and their current performance level as a senior. For each of these questions, participants selected the highest categorical response from options that included: local, city, regional, provincial/state, national, and international levels. Secondly, they were asked to accurately report (1) their best competitive performance ever and (2) their best competitive performance in the past 12 months. In these cases, participants indicated the specific event type (e.g., 100m freestyle) along with the corresponding performance mark (e.g., time in minutes: seconds, or distance in meters) and the name of the competition and date where this mark was achieved.

Self-regulated learning survey. The SRL-SRS (Toering et al., 2012) examines how individuals are active participants in their own learning process. The SRL-SRS is a dispositional self-regulated learning questionnaire used in sport and various domains. It consists of 46 Likert-scale items comprising six subscales that assess planning, self-monitoring, evaluation, reflection, effort, and self-efficacy. Toering et al. (2012) configured their various subscales based on prior instruments assessing planning and effort (Self-Regulatory Inventory; Hong & O'Neil Jr., 2001), self-monitoring (Self-Regulation Trait Questionnaire; Herl et al., 1999), evaluation (Inventory of Metacognitive Self-Regulation; Howard, McGee, Shia, & Hong, 2000), reflection (Reflective Learning Continuum; Peltier, Hay & Drago, 2006), and self-efficacy (Generalized Self-efficacy Scale; Schwarzer & Jerusalem, 1995). Toering et al. (2012) made slight modifications to the items on the original subscales to make the questionnaire comprehensible to adolescent

populations and their preface asked participants to think about items across various domains, in relation to solving problems and executing task during sports, when playing a musical instrument, and at work. Toering et al.'s subscales have Likert-scale items anchored at 1- 'Almost Never' and 4 - 'Almost Always'; exceptionally, the evaluation items are anchored at 1- 'Never' and 5- 'Always' and reflection items are anchored at 1- 'Strongly Agree' to 5 - 'Strongly Disagree'.

Toering et al. (2012) had advocated for the use of the SRL-SRS in specific sport domains, yet they had equally employed the scale in a generalizable fashion across sport and academic contexts (Jonker et al., 2010; also see McCardle, 2015). Thus, we conducted substantial pilot work on the SRL-SRS items to confirm that content was sufficiently specific to the sport training context. We vetted 50 SRL-SRS items (including four that were dropped by Toering et al., during factor analysis) with nine professor-researchers, all independent from the current research team, and each versed in SRL notions and sport practice. Each researcher was asked to complete an evaluation sheet where they judged each SRL-SRS item based on three criteria: (1) whether the item was readable, (2) whether the item was pertinent to its intended subscale, and (3) whether the item would allow us to learn about how athletes are active participants in their own learning process in a sport practice setting. They were asked to agree, slightly agree or disagree with each of the three questions relating to each item, and were encouraged to add comments and recommendations for problematic items.

After collating the reviewers' judgments and comments, problematic items were flagged and efforts were taken to revise items to better fit a sport training context, trying to make edits as minor as possible. This face validity review indicated that many of Toering et al.'s (2012) original items could be supplemented with "during practice" to make them context-specific. Comments from researchers echoed concerns that certain items were not relatable to athletes, and

other comments reiterated concerns about poor readability of some items. In particular, reviewers' feedback indicated problems with wording around "solving problems" and "calculations", with recommendations to rephrase these items. In response, we amended items such as "I determine how to solve a problem before I begin" to become "I determine how to approach a practice task before I begin" to ensure they were better understood by athletes. In cases of problematic readability, we retraced several of Toering et al.'s items (e.g., "I know how to handle unforeseen situations because I can well think of strategies to cope with things that are new to me") back to their original subscale source and reinserted the original item (e.g., "I know how to handle unforeseen situations during practice, because I am resourceful") when we judged it to be more coherent. Two items were completely removed because reviewers' ratings consensually demonstrated poor readability and very poor pertinence to athletes in training, and because reviewers' comments suggested these items would need to be significantly modified to be retained (i.e., "I check to see if my calculations are correct" and "If someone opposes me, I can find means and ways to get what I want"). Table 1 shows our 48 items refined from the SRL-SRS based on reviewers' face validity comments, as they compare to Toering et al.'s original catalogue of items, and subscripts indicating the nature of minor modifications.

Furthermore, we took steps to remedy prior limitations relating to scale anchors. Anchors for subscales of planning, self-monitoring, evaluation, reflection and effort were changed to a 1-7 scale to ensure greater variability in scores for each item. Additionally, the self-efficacy scale was assigned anchors ranging from 1 - 'Strongly Disagree' to 7 - 'Strongly Agree' to avoid confounds between frequency words in the items and frequency scale anchors used previously (Toering et al., 2012). Finally, we added a new preface to prompt respondents to reflect on tasks done before, during and after practice tasks. In sum, we made minor adaptations to the SRL-SRS based on

extensive vetting of face content validity with knowledgeable researchers in the field of self-regulated learning, and these minor alterations were applied foremost to improve the context-specific nature of items while respecting the conceptual aspects of Toering et al.'s subscales.

Amounts of sport-specific practice. We used questions from Hopwood's (2013) Developmental History of Athletes Questionnaire to obtain practice data for one's primary sport. Participants reported amounts of sport-specific practice for a "typical week" of training that is 10 weeks prior to their major competition of the season. Athletes reported weekly hours in sport-specific practice in four conditions: (1) where a coach is present providing supervision to you and others, (2) a coach is present providing one-on-one supervision, (3) no coach is present but you are practicing with others, (4) no coach is present and you are practicing alone. These four conditions combined yielded amounts of sport-specific practice.

Reliability

Information obtained for practice and performance were considered to be reliable. Participants were asked to complete these measures while using external sources for recall: 70% of respondents indicated they consulted either a personal training log (53% used this), online archived results (45%) or other sources such as videos or GPS electronics (3%). Additionally, 74% of participants provided a web-link to verify their best performance mark.

Planned Analyses

First, we separated our athletes into three different and incrementally skilled performance groups. Our main analyses included a series of logistic regression analyses to explain the likelihood of being in incrementally progressively more skilled performance groups based on scores from the SRL-SRS. Specifically, we wished to explain membership in increasingly skilled

groups as a function of composite SRL (overall engagement in all SRL processes), and as a function of the six constituent SRL processes from the SRL-SRS simultaneously, and singularly.

Results

Preliminary Analyses

An initial missing values analysis showed no more than 1.2% of data missing for any variable; thus, influences of missing data were not a concern (Tabachnick & Fidell, 2013). No participant had more than one data point missing across all items on the SRL-SRS questionnaire. Missing values were imputed using multiple imputation in SPSS v.22.

Validity of skill level groups. We took multiple steps to validly separate or bin our athletes into different performance groups. We first inspected participants' categorical responses to the six levels (local, city, regional, provincial/state, national, international) for highest level of representation as senior athletes. Taking a large segment of our sample comprising male track and field athletes and runners ($n = 120$), who reported objective measures of performance for standardized events, we were able to attribute a score to each individual's best performance mark for events that are scored on the International Association of Athletics Federations (IAAF) Scoring Tables (Spiriev, 2014). IAAF Tables use a tested algorithm to determine equivalent performance scores across different events; therefore, the tables can be used to reliably generate a large sample of comparable performance level data achieved in different athletic events. We further calculated mean scores for each of the six categorical performance levels (see Appendix L). A one-way ANOVA showed a significant group differences for IAAF scores, $F(5, 114) = 31.80, p < .01, \eta^2_p = 0.58$. Post hoc analyses showed significant differences between all groups (all $ps < .01$) except local and city, regional and provincial, and national and international (see Table 2). Additional inspection of confidence intervals showed no overlap in the upper bounds

for the city group with the lower bounds for the regional group, nor any overlap in the upper bounds for the provincial group with the lower bounds for the national group. This informed our decision to re-group our six performance categories into three performance level groups and to re-run a one-way ANOVA; results showed significant differences between the three progressive performance groups, $F(2, 117) = 79.32, p < .01, \eta^2_p = 0.58$, with significant post-hoc differences between each group, all $ps < 01$. Thus, we validated the discriminant validity of our new three performance groups in the current study: specifically, the local and city athletes were merged into a ‘recreationally competitive’ group ($M_{\text{IAAF Score}} = 272.5, SD = 241.6, 95\% \text{ CI} = 183.9 - 361.2$), the regional and provincial athletes merged into a ‘less-elite’ group ($M_{\text{IAAF Score}} = 618.3, SD = 213.9, 95\% \text{ CI} = 552.4 - 684.1$) and the national and international athletes merged into an ‘elite’ ($M_{\text{IAAF Score}} = 870.5, SD = 164.1, 95\% \text{ CI} = 821.8 - 919.3$) group.

The same was done with 40 female track & field athletes and runners with our three predetermined groups to verify the validity of our grouping for females. The one-way ANOVA was also significant, $F(2, 37) = 32.45, p < 0.01, \eta^2_p = 0.64$, and post hoc analyses showed significant group differences between all three groups, all $ps < .03$. After verifying the discriminant validity of our skill groups for 58% of our sample, we were confident in using these three distinct escalating performance groups for all subsequent planned analyses. For the rest of the sample, we used the highest self-reported categorical response to assign individuals accordingly to either the recreationally competitive, less-elite, or elite groups.

We examined age and gender for possible sampling bias in the performance groups. A one-way ANOVA showed significant age group differences, with the recreationally competitive group being older than each of the two higher performance groups, $p < .001$. Therefore, in all subsequent multinomial logistic regression analyses that included the recreationally

competitive group, age was added as covariate. A chi-square test also showed significant differences for gender representation by performance group ($p = .02$) with the most skilled performance group showing greater representation of females than each of the other lesser-skilled groups. Therefore, in all logistic regressions to explain skill group membership, gender was added as covariate to control for sampling bias.

Factor analyses on the refined SRL-SRS. To determine whether our refined six factor, 48-item SRL-SRS model fit the observed data, inspection of confirmatory factor analysis (CFA) indices was completed using an ML estimation method with the AMOS 21 program. When inspecting the fit of a measurement model, indices of good fit are: $CFI \geq .90$, $SRMR \leq .08$, $RMSEA \leq .05$, and $\chi^2/df \leq 5$ (Hair, Black, Babin, & Anderson, 2010). Results revealed that the model fell short of criteria for adequate fit: $CFI = .842$, $IFI = .843$, $SRMR = .098$, $RMSEA = .055$ (90% $CI = .051 - .058$), and $\chi^2/df = 1.807$. Moreover, significant multicollinearity was present as seven of the fifteen correlations between the various subscales were above 0.7 (Kline, 2010). Specifically, four of the seven high correlations were above 0.8, ranging up to 0.95 (see Appendix M1). Furthermore, the Average Variance Extracted (AVE) scores for five of six factors were below 0.5, meaning that the majority of variance in each item was not explained by their respective factors, suggesting poor convergent validity within the factors (Hair et al., 2010). Maximum Shared Variance (MSV) scores were calculated by determining the largest correlation each factor had with another and squaring the correlation coefficient. If MSV scores are smaller than their AVE counterpart scores, it can be concluded that all factors explained more variance within their own items than the variance in items that were shared with any other factor, indicating strong discriminant validity (Hair et al., 2010). However, all our resultant factors had larger MSV than AVE scores, suggesting poor discriminant validity.

Therefore, a further exploratory factor analysis (EFA) in SPSS to modify our version of the SRL-SRS was justified to improve model fit. Principal axis factoring with direct obliminal rotation was used to avoid the inflation of estimates of variance accounted for (Costello & Osborne, 2005). The KMO measure of sampling adequacy was .92, above the recommended value of .6, and Bartlett's test of sphericity was significant, $\chi^2(1128) = 6180.1, p < .01$. Communalities were all above 0.2, further confirming that each item shared common variance with other items. An iterative EFA was conducted with factor loading criteria set to include primary loadings of 0.32 or greater, and to delete items when absolute differences between primary loadings and cross-loaded values did not exceed 0.2 (Tabachnick & Fidell, 2013), all the while keeping conceptual interpretations in mind when deleting items. Resultant factors were required to comprise at least two items (Tabachnick & Fidell, 2013). The initial Eigenvalues > 1.0 revealed 10 factors, however based on the aforementioned criteria, 17 items were removed on successive runs through an iterative process. "I check my work all the way through a practice session", intended by Toering et al. (2012) to be a self-evaluative item, loaded on the self-monitoring factor. We kept this item on our self-monitoring factor because it was conceptually consistent with all the other items on this factor that pertained to 'on-line' processes executed during a task, as opposed to 'after a task', which would correspond to the evaluation scale. All items removed during the EFA iterations are indicated with double asterisks in Table 1. The final factor loading matrix is shown in Table 3. This final solution comprised 31 items, explaining 49.49% total variance, with the factors entitled the same as Toering et al.'s six SRL subscales.

Fit indices of this resultant six-factor, 31-item model were then re-examined in AMOS to confirm whether our refined SRL-SRS model resulted in a good fit. The refined measurement model was significantly improved, now surpassing criteria for good fit: CFI = .904, SRMR =

.078, IFI = .905, RMSEA = .052 (90% CI = .045 – .058), and $\chi^2/df = 1.724$. Figure 1 displays this final measurement model as well as standardized regression weights for individual items. In addition, all correlations between latent factor scores, except one, were below .7, indicating that multicollinearity issues had been cleared up substantially (see Appendix M2). Further, significant improvements were made on both convergent and divergent validity. Four of the six factors now showed good convergent validity (i.e., AVE > .5) and three factors showed good divergent validity (i.e., where MSV < AVE). Although three of the factors still fell short of the divergent validity criteria, all showed significant improvement from the earlier tested model.

In order to proceed with subsequent analyses, factor scores were calculated for each of the six SRL (*constituent*) processes as well as for overall (*composite*) SRL. First, items representing each of the six SRL subscales were averaged, with each of these mean scores becoming the six independent (interval) variables. Each of the subscale scores retained a distribution with full variability. All six subscales were tested for normality and showed acceptable values of skewness (range = 0.87 to -1.12) and kurtosis (range = -0.97 to 1.60). Secondly, assuming that each of the six variables in the SRL-SRS carry the same weight, the six constituent scale scores were added and then averaged to create a composite SRL score. Skewness and kurtosis were also within an acceptable range showing normality (skewness = -0.42; kurtosis = 0.092).

Descriptive statistics and between group differences. Descriptive statistics on age, gender and hours of sport-specific training per week by performance group are shown in Table 4 along with mean levels and standard deviations for each SRL subscale score and the composite SRL score. A one-way MANOVA was conducted with the six SRL subscales as the dependent variables and the highest performance level as the independent variable. With the use of Wilks' criterion, the combined DVs were significantly different based on athletes' performance levels, F

(12, 528) = 2.02, $p = .017$; Wilk's $\Lambda = 0.912$, $\eta^2_p = .045$. Specifically, differences were found on self-monitoring, $F(2, 269) = 6.94$; $p = .001$; $\eta^2_p = .049$, effort, $F(2, 269) = 6.16$; $p = .002$; $\eta^2_p = .044$, self-efficacy, $F(2, 269) = 5.05$; $p = .007$; $\eta^2_p = .036$, and planning, $F(2, 269) = 3.58$; $p = .029$; $\eta^2_p = .026$. Inspection of post hoc analyses using Tukeys HSD showed elite athletes to have reported higher levels for each of self-monitoring ($p = .002$), effort ($p = .003$) and self-efficacy ($p = .032$), than the recreationally competitive group. In addition, results showed elite athletes to have reported higher levels of self-efficacy ($p = .024$) and planning ($p = .047$), than the less-elite group (see Table 4). Additionally, a one-way ANOVA showed differences on composite SRL based on athletes' performance levels, $F(2, 272) = 7.19$; $p = .001$; $\eta^2_p = .051$. Post hoc analyses indicated that elite athletes had higher composite SRL scores compared to recreationally competitive athletes ($p = .004$) and the less-elite athletes ($p = .011$). As a final step before executing our planned logistic regression analyses, we performed preliminary analyses to evaluate outliers as per processes specified by (Tabachnick & Fidell, 2013). Separate multiple binary logistic regressions were conducted between the recreationally competitive and less-elite groups, and between the recreationally competitive and elite groups. Specifically, four cases with Cook's values > 1 or standardized residuals > 3 were marked as overly influential cases and excluded.

Planned Analyses to Explain Skill Group Membership

Composite SRL scores. Using the composite score as an independent variable, and age and gender as control variables, a multinomial logistic regression examined the likelihood of belonging to each of the increasingly skilled performance groups. The recreationally competitive (rec comp) group was the reference group. Good model fit was found, $\chi^2(526, N = 268) = 458.75$, $p = .98$, using a deviance criterion, and Nagelkerke $R^2 = .30$. The model was significant,

with log-likelihood ratios positively and significantly predicting likelihood of being in increasing skilled groups, compared to membership in the rec comp group, $\chi^2(2, N=268) = 15.6, p < .001$. Inspection of the parameter estimates showed that as individuals reported a one standard deviation (SD) increase in composite SRL, they were 3.15 times as likely to belong to the elite group compared to the rec comp group (see also N1). Correct classification rates were 41.9% for the rec comp group, 38.0% for the less-elite group and 76.7% for the elite group. Overall correct classification was 57.8%, representing an improvement of 48.8% in classification better than chance.

Since multinomial logistic regressions only compare the two higher performance groups to the rec comp group, further inspection of differences between the less-elite and elite groups were performed. We ran a binomial logistic regression, controlling for gender, to predict the likelihood of an athlete being in the elite group relative to the less-elite group. A test of the full model against a constant only model was statistically significant, indicating that the model with the composite SRL predictor reliably distinguished between performance groups, $\chi^2(2, N=225) = 15.43, p < .001$, with good fit, $\chi^2(8, N=268) = 7.71, p = .46$, Nagelkerke's $R^2 = .089$. Further inspection showed that as individuals reported a one SD increase in overall SRL, they were 1.82 times as likely to belong to the elite group compared to the less-elite group (see Appendix N2). The Wald criterion demonstrated that composite SRL made a significant contribution to predictions, $p = .007$. Overall correct classification success was 62.2% (34.8% for less-elites and 81.2% for elites), representing an improvement of 20.4% in classification better than chance.

Constituent SRL processes. To determine whether an athlete's score on specific SRL processes predicted the likelihood of being in increasingly skilled performance groups, we performed a simultaneous multinomial logistic regression using the six constituent SRL scores as

independent variables. The rec comp group was the reference group. Results showed a significant model, $\chi^2(16, N=268) = 444.08, p < .001$ with good fit, $\chi^2(518, N=268) = 444.08, p = .99$, using a deviance criterion, Nagelkerke $R^2 = .35$. After controlling for age and gender, self-monitoring proved to be the only constituent SRL variable with a significant contribution, as evidenced by likelihood ratio test values. Self-monitoring positively and significantly predicted the likelihood of membership in increasing skilled groups, compared to membership in the rec comp group, $\chi^2(2, N=268) = 11.57, p = .003$. No other values derived from the likelihood test showed any other constituent SRL variable to be significant (all $ps > .082$); thus, only the Wald statistic for self-monitoring was inspected. Parameter estimates showed that as individuals reported a one SD increase in self-monitoring, they were 2.75 times as likely to belong to the elite group ($p = .001$), and 2.25 times as likely to belong to the less-elite group ($p = .011$), compared to the rec comp group (also see Appendix N3). Correct classification rates were 37.2% for the rec comp group, 41.3% for the less-elite group and 79.7% for the elite group. Overall correct classification was 59.7%, representing an improvement of 53% in classification better than chance.

To inspect differences between the less-elite and elite groups, we ran a binomial logistic regression with the six constituent SRL processes as independent variables, controlling for gender. Although the model proved significant, $\chi^2(7, N=225) = 20.69, p = .004$, with good model fit $\chi^2(8, N=225) = 10.00, p = .26$, Nagelkerke's $R^2 = .118$, the Wald criteria showed no significant contributions for any of the constituent SRL processes in distinguishing less-elite and elite membership (all $ps > .075$; Appendix N4). Table 5 gives an overview summary of all significant findings that distinguished between the groups and their particular parameter estimates (see also Appendix O)

Singular drill down regression analyses. In order to verify the value of a single constituent SRL process in the elite or less-elite group compared to the rec comp group, we performed multinomial logistic regressions, controlling for age and gender, with only one SRL process in the regression at a time. All models showed good model fit with all $ps > .76$ and Nagelkerke R^2 ranging between .26 and .30. Planning, self-monitoring, effort and self-efficacy predicted the likelihood of membership in increasing skilled groups (all $ps < .018$). Inspection of parameters of each of the regressions showed as individuals reported a one *SD* increase in self-monitoring, they were 3.03 times as likely to belong to the elite group ($p < .001$) and 2.08 times as likely to belong to the less-elite group ($p = .005$), compared to the rec comp reference group. Similarly, with a one *SD* increase in reported effort, athletes were 2.05 times as likely to belong to the elite group ($p = .005$) than the rec comp group. Athletes were 1.90 times as likely to belong to the elite group with a one *SD* increase in self-efficacy ($p = .006$) and were 1.62 times as likely to belong to the elite group with a one *SD* increase in planning ($p = .013$), in each case compared to the rec comp reference group. Neither evaluation, nor reflection showed any significant contribution to membership in increasing skilled groups (all $ps > .10$).

Binomial logistic regressions, controlling for gender, were also performed for each SRL process. Significant models were found for planning, self-monitoring, effort and self-efficacy with all $ps \leq .002$ and Nagelkerke R^2 values ranging from .008 to .094. Inspection of these parameter estimates showed that as individuals reported a one *SD* increase in the respective SRL process, they were 1.61 (self-efficacy; $p = .004$), 1.55 (self-monitoring; $p = .016$), 1.46 (effort; $p = .037$) and 1.33 (planning; $p = .034$) times as likely to belong to the elite group compared to the less-elite group. No significant differences were found for evaluation and reflection for predicting membership in the elite relative to the less-elite group (all $ps > .116$).

Discussion

The first purpose was to examine the factor structure of the SRL-SRS in an adult North American individual-sport population. Prior research has validated this survey with secondary school 11-17 yr-old Dutch adolescents (Toering et al., 2012). Our work to vet the content of items with experienced, independent reviewers indicated that they should be better tailored to a sport training context. Therefore, encompassing these changes to improve face validity, we made minor modifications to Toering et al.'s (2012) items to better reflect such a context for competitive athletes in training. When these items were further submitted to an EFA and the resultant model was examined for fit, results provided preliminary support for the factor structure of our refined SRL-SRS. An examination of CFA indices showed good model fit. In addition, four of the six factors had high internal consistency with Cronbach's alpha above .80 and a fifth factor with an acceptable alpha of .69. However, the reflection subscales only contained two items with a Cronbach's alpha just falling short of the .70 criteria, therefore we cannot yet put great confidence in this subscale. Moreover, during the iterations of the EFA, three reflection items seemed to mostly load on the same factor as evaluation. Future research should consider either merging these two factors as a single factor or take steps to create items to be able to better distinguish them. In terms of convergent, and divergent validity across the six constituent scales of the SRL-SRS, we submit that our work has made significant improvements, however a few factors still fall short of criteria for convergent validity (planning and self-monitoring) and divergent validity (planning, self-monitoring and evaluation).

Importantly, even with our refinements to make the items more context-appropriate, and even with the refinements and trimming of items to improve the factorial validity of the subscales, the resultant subscales remain congruent with the six scales identified by Toering and

colleagues (2012). Furthermore, these six scales conceptually capture many of the psychological processes advocated by Zimmerman (2006) for effective self-regulation of motor learning, upon which Toering et al. (2009) based their work (also see Young & Medic, 2008; Tedesqui & Young, 2015, for support of Zimmerman's SRL cycle in sport training).

With greater confidence in the refined SRL measures, we pursued the main purpose of this study. Specifically, we examined the relationship between composite SRL and performance level, and also relationships between specific constituent SRL processes and performance level. Elsewhere, in the domains of music and academia, there is evidence that self-regulated learning plays an important role in individuals' attained performance levels (Zimmerman & Pons, 1986; also see Kitsantas, Winsler, & Huie, 2008; Nota, Soresi, & Zimmerman, 2004). However, only a few studies have examined this phenomenon in sport (Cleary & Zimmerman, 2001; Toering et al., 2009; Zimmerman & Kitsantas, 2002) and there is a need to better understand whether self-regulating frequently, or engaging in particular self-regulatory processes frequently, is associated with higher performance levels.

Our results revealed that a higher score in *composite SRL* is associated with a greater chance of athletes belonging to the elite group. The effect sizes corresponded to what would be explained in an expertise framework, where likelihood effects of overall SRL attributed to elite performance were very pronounced relative to rec comp athletes, and moderately pronounced compared to less-elite athletes. These findings strengthen confidence in the fact that composite SRL, or generally a greater engagement in many processes of self-regulated learning, is associated with higher performance levels. Only one other study accounted for composite SRL; in an in-situ study of collegiate volleyball players in the practice environment, Kitsantas and Zimmerman (2002) assessed 12 self-regulatory measures and combined them into a single score.

This single overall SRL score correlated very strongly with performance on a volleyball serving task, accounting for 90% of the variance of performance. However, neither this study nor other research has used a survey-based composite SRL score to distinguish between skill groups. Our regression results and between-group analyses showed that composite SRL could be a distinguishing factor explaining our most elite group from lesser-skilled groups; however, we could not replicate similar differences in composite SRL between the two lesser skilled groups. This suggests that composite SRL may represent an advantage attributable to elite athletes, who based on the current findings, also appear to be the athletes who report generally a greater engagement in SRL processes in training than their lesser-skilled counterparts.

Multinomial and binomial regression results suggested that elite athletes rely more heavily overall on self-regulated learning in their practice behaviours. We sought to explore further questions, such as: which specific processes are accounting for the benefits of overall SRL, and how much value does each SRL process bring to overall SRL? Are more elite athletes gaining an advantage by engaging in more of each process, or do they engage in greater amounts in select processes? Results from the simultaneous logistic regressions for the six constituent SRL processes showed *self-monitoring* was the only process predicting the likelihood of membership in increasingly skilled groups, with individuals being 2.75 times as likely to belong to the elite group and 2.25 times as likely to belong to the less-elite group compared to the rec comp group. Interestingly, the odds ratio for self-monitoring for the elite group, compared to the rec comp group, was not as strong as the odds ratios attributable to overall SRL (3.15). Additionally, whereas self-monitoring did not discriminate the elite from the less-elite group (only from the rec comp group) in the simultaneous regression analyses, overall SRL discriminated the elite group from each of the less-elite and the recreationally competitive groups. This latter finding, i.e.,

being able to discriminate the most elite group from each of multiple less-skilled groups, is a hallmark for determining a valid expert advantage in the sport expertise framework (Ericsson & Smith, 1991). The point is that, although self-monitoring is a critical process, our results also suggest that there may be other constituent SRL processes beyond self-monitoring contributing to the elite group's benefit from overall SRL, for which unique effects were not evident in the simultaneous regressions.

To help delineate how each SRL process on its own explained group membership, we look to our findings from the singular drill-down logistic regressions for each of the six constituent SRL processes. Four of the six constituent SRL processes were predictive of membership in the elite skill group, relative to the less-elite group, and also relative to the rec comp group: *self-monitoring*, *planning*, *effort* and *self-efficacy*. In each of these cases, effect sizes corresponded to the skill group ladder – odds ratios were always higher for likelihood ratios relating to the contrast between elite and rec comp, than they were for the contrast between elite and less-elite groups. These regression findings, which supported an elite group advantage, were also mirrored in the between-group mean level differences found for the same four processes – in all cases, elite athletes had a greater engagement in each of the four processes than one of the lesser-skilled groups. We can deduce that online checking and monitoring of training, planning tasks ahead of training, putting more effort towards task execution when training tasks become increasingly demanding, and having higher self-efficacy and better coping mechanisms in the face of training difficulties, are each associated with higher sport performance levels. Notably, self-monitoring stood out as being the only constituent process that explained skill group differences in all multinomial and binomial contrasts.

With respect to constituent SRL processes, our findings affirm, differ from, and extend limited research relating to elite athletes. Like Toering et al. (2009), we found elite athletes benefit from processes associated with effort, however these effects were only apparent in singular regressions where the covariance associated with other SRL variables, including self-monitoring, had been removed. Our results echo those from Kitsantas and Zimmerman (2002), where experts had greater structure of the planning of their daily practice routines, reported higher self-efficacy levels after unsuccessful volleyball serves (i.e., when confronting difficulties at practice), and reported that they self-monitored aspects of their technique and practice outcomes more frequently, than non-experts and novices. Similarly, our results for self-efficacy also corroborate those from Cleary and Zimmerman's (2001), wherein experts had significantly higher self-efficacy judgments after two consecutive misses than non-experts and novices.

Findings showed self-monitoring to be the most important constituent process for predicting more elite group membership. Literature indicates self-monitoring may be crucial for enhancing learning and attaining higher skill levels in the academic context (Zimmerman & Paulsen, 1995). It has been shown to help students perform better on course tests and facilitates the use of other SRL strategies (Lan, 1996). In sport, self-monitoring can be applied to enrich one's training, especially with respect to motor skill acquisition (Zimmerman, 2006). Meta-cognitive self-monitoring refers to processes that enhance a learner's awareness of their actions during practice tasks (Jonker et al., 2010). Self-monitoring selectively focuses on information that helps assess an ongoing practice task, helping a learner to assess progress, to determine potential sources of error, confusion, or inefficiency in their actions; this information can be further used by the learner to make necessary changes to reach learning goals (Bandura, 1986; Harkin et al., 2016). An athlete can self-monitor their use of practice strategies during training, and this

information can be further used by the learner to discern the usefulness of various approaches to learning. They can also self-monitor the personal effort they allocate to various strategies as they are implemented at practice, meaning that self-monitoring becomes an on-line process for negotiating and pacing one's practice activities (Zimmerman, 2000). Finally, effective self-monitoring fosters an environment for post-practice reflective thinking (Bandura, 1986).

Overall, self-monitoring is a key process for on-line attention and gathering of information upon which many other processes in the SRL cycle (Zimmerman, 2006) may be predicated (Winnie & Hadwin, 2008). This may indirectly be why we found elite group membership was associated with planning processes – when planning for a practice, athletes must be aware and appraise the demands of a task before its execution. Much of this awareness may be predicated on self-monitoring (of training conditions, personal efforts, on-line adjustments of strategies, and completion of tasks) that occurred at a prior practice. Neither evaluation nor reflection were significant contributors to performance level in our study, which might suggest neither critically distinguishes elite skill groups (cf., Kitsantas & Zimmerman, 2002). All athletes in our study reported high mean levels for both self-reflection and self-evaluation. It may be that, because elite athletes have better self-monitoring skills, they may evaluate in a more effective way (e.g., making more accurate self-judgments) or have more enriched reflection on practice; this remains speculation however that is not borne out by results from the evaluation and reflection scales (in which items were frequency- and not quality-based) used in this study.

Self-monitoring may also impact motivational self-regulatory processes within a practice setting. For example, feedback from self-monitoring can show unexpected progress, which in turn increases a learner's perceptions of self-efficacy, outcome expectations, future goals and, ultimately, their motivation (Zimmerman & Paulsen, 1995). The critical link between self-

monitoring and other motivational processes of self-regulation may explain why elite group membership in the current study could be attributed, albeit with weaker effect sizes, to self-efficacy and effort processes. Notably, our findings showed that effects for these motivational variables from the SRL-SRS (i.e., self-efficacy, effort) became significant only in singular regression analyses where simultaneous covariance from self-monitoring was not considered.

In sum, our results suggest that a meta-cognitive self-monitoring advantage may be attributed to more elite athletes. This advantage may be a result of practice they have monitoring their activities over many years of training, thereby learning to monitor across varied and voluminous bouts of practice. On the other hand, meta-cognitive self-monitoring may be difficult for rec comp athletes because the amount of information involved in complex tasks can be overwhelming and lead to inconsistent monitoring (Zimmerman, 2006), whereas elite athletes may be selective in their cognitive self-monitoring during practice (Abrahams, 2001) because they know what is relevant and know what to prioritize and what to look for when monitoring (Helsen & Starkes, 1999). It is noteworthy that self-monitoring was associated with significantly greater likelihood of being in the less-elite group than the rec comp group (evident in both the simultaneous regressions with all constituent variables, and also in the singular regression). This suggests that, to make progress in optimizing learning in sport training at sub-elite levels, self-monitoring may be especially important.

Results from this study suggest that self-monitoring is critical but also must be integrated within a larger cycle of SRL processes (Zimmerman, 2000). Our results relating to composite (overall) use of SRL processes where each of the six SRL processes were equally weighted and averaged, suggest this is the case. Our results also suggest that engaging in more than just self-monitoring is key for planning, effort and self-efficacy, which together contribute to the overall

SRL advantage for elite athletes. We point to the differences between our two higher skill groups to postulate the following: more elite athletes tend to more frequently use self-monitoring in combination with other SRL processes such as planning, effort, and self-efficacy. The less-elite athletes may indeed have a self-regulatory advantage over rec comp counterparts, but compared to more elite athletes, they tend to focus more so on self-monitoring without integrating other self-regulatory processes. We propose that elite athletes self-monitor more frequently and integrate these processes within a SRL cycle, enhancing the quality of their training. However, one of the caveats of the current discussion is the assumption that better-developed SRL processes translate into a more effective learning environment (e.g., enhanced amounts of DP or quality DP), which may ultimately lead to higher-level sport performance (Bonneville-Roussy & Bouffard, 2015). Recently, studies in music have shown that SRL may be linked to quality of practice; hence, it may be that the optimization of practice may lead to skill group differences (Araújo, 2015; Bonneville-Roussy & Bouffard, 2015). In sport, planning and reflection were positively related to training volume, which in turn was predictive of short-term performance improvement (Elferink-Gemser et al., 2015). However, our study did not analytically relate SRL to the hours of training or DP, and therefore concrete conclusions on the quality of practice cannot be advanced.

Strengths, Limitations and Future Research

Our study brings a few strengths compared to previous work. We included three progressively skilled athletic groups, which were validly and reliably binned into appropriate skill groups. We also used contextualized sport items, improving the face validity of the SRL-SRS, along with examining CFA criterion indices within a sport sample. Moreover, in our analyses, each of the subscale scores retained a distribution with full variability, which is an analytic

strength compared to Toering et al. (2009) who fractured each of their SRL-SRS independent variables into low, medium and high groupings for regression purposes. Our study also includes a composite SRL score, which allows us to compare odds ratios between composite and the constituent SRL processes, and inferring their relative importance.

Despite these strengths, there were four main limitations. First, since our results pertain to individual sports, our results may not generalize to team sports, as there may be differences in ways in which athletes self-regulate between team and individual sports (Jonker et al., 2010). Second, although many of the psychological processes of Zimmerman's (2006) SRL cycle are represented in this study, some processes are not included. Future research should consider including some of the lacking processes such as self-reaction, goal setting and causal attributions. Future research should also confirm whether more frequent use of overall SRL or constituent SRL processes are associated with greater amounts of practice, or enhance quality practice. Although some studies have looked into incorporating training hours or DP with path analysis, no studies have pursued true mediation analyses to see how SRL contributes to skill group membership through training volume or DP. Third, the current study is cross-sectional. Longitudinal studies are needed to determine the causality and cumulative effectiveness of various SRL processes on the acquisition of higher sport performances. And lastly, there are limits to using a self-report questionnaire, as self-reported practice procedures and authentic practice may differ (Chaffin & Imreh, 2001). Future research might consider using observational or experimental methods to confirm or challenge the present findings.

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Table 1

Inventory of Items for the Original SRL-SRS Compared to the Refined Sport Inventory Presented to Participants in the Current Investigation

Original SRL-SRS (Toering et al, 2012)

The following questions are about how you solve problems and execute tasks. These can be all kinds of problems and tasks, such as training, in your sports, when playing a musical instrument, at work, etc. Carefully read the statements. After you have read each statement think about it and tick the box that best applies to you.

PLANNING:

1. I determine how to solve a problem before I begin.
2. I think through in my mind the steps of a plan I have to follow.
3. I try to understand the goal of a task before I attempt to answer.*
4. I ask myself questions about what a problem requires me to do to solve it, before I do it.
5. I imagine the parts of a problem I still have to complete.
6. I carefully plan my course of action to solve a problem. of action.

Refined SRL-SRS

Please read the following statements and choose the number that best describes the way you act when approaching challenges, difficulties, and/or tasks in your sport training.

Think about a challenge or difficulty you might face during practice. Think about when you have to overcome a difficult practice task. What do you do before you start? What do you do while you work out? What do you do after difficult practice tasks? And how often you act like this when approaching practice tasks? There are no right answers -- please describe yourself as you are, not how you want to be or think you ought to be.

PLANNING:

1. I determine how to approach a practice task before I begin.
2. Before I do a practice task, I think through the steps in my mind.^a
3. I try to understand the goal of a practice task before I do it.
4. I ask myself questions about what a practice task requires me to do before I do it.^a
5. Before practice, I imagine the parts of a task I have to complete.**
6. Before practice tasks, I carefully plan my course of action.^a

7. I figure out my goals and what I need to do to accomplish them.

8. I clearly plan my course of action to solve a problem.

9. I develop a plan for the solution of a problem.

SELF-MONITORING

10. While doing a task, I ask myself questions to stay on track.*

11. I check how well I am doing when I solve a task.

12. I check my work while doing it.

13. While doing a task, I ask myself, how well I am doing.

14. I know how much of a task I have to complete.*

15. I correct my errors.

16. I check my accuracy as I progress through a task.

17. I judge the correctness of my work.

EVALUATION

18. I look back and check if what I did was right.

19. I double-check to make sure I did it right.

20. I check to see if my calculations are correct.^b

21. I look back to see if I did the correct procedures.

22. I check my work all the way through the problem.

23. I look back at the problem to see if my answer makes sense.

24. I stop and rethink a step I have already done.

25. I make sure I complete each step.

REFLECTION

7. Before practice tasks, I figure out my goals and what I need to do to accomplish them.

8. I clearly plan my course of action before starting practice tasks.^a

9. I develop a plan for resolving difficulties at practice.

SELF-MONITORING

10. While doing a practice task, I ask myself questions to stay on track.**

11. I check how well I am doing during practice tasks.

12. I check aspects of my workout while doing it.

13. I ask myself how well am I doing as I proceed through practice tasks.^{a**}

14. While I am engaged in a practice task, I know how much of it I still have to complete.

15. I correct my errors during practice tasks.**

16. I check my accuracy as I progress through a practice task**

17. I judge the correctness of what I do in workout.**

EVALUATION

18. I look back and check if what I did in practice was right.

19. I double-check to make sure I did practice tasks right.

21. I look back to see if I did the correct procedures at practice.

22. I check my work all the way through a practice session.

23. After finishing, I look back on the practice task to evaluate my performance.

24. I stop and rethink a step I have already taken at practice.**

25. I make sure I complete each step in my approach to practice tasks.**

REFLECTION

26. I reappraise my experiences so I can learn from them.
27. I try to think about my strengths and weaknesses.
28. I think about my actions to see whether I can improve them.
29. I think about my past experiences to understand new ideas.
30. I try to think about how I can do things better next time.

EFFORT

31. I keep working even on difficult tasks.
32. I put forth my best effort when performing tasks.
33. I concentrate fully when I do a task.
34. I don't give up even if the task is hard.
35. I work hard on a task even if it is not important.
36. I work as hard as possible on all tasks.
37. I work hard to do well even if I don't like a task.
38. If I'm not really good at a task I can compensate for this by working hard.
39. If I persist on a task, I'll eventually succeed.
40. I am willing to do extra work on tasks in order to learn more.

SELF-EFFICACY

41. I know how to handle unforeseen situations, because I can well think of strategies to cope with things that are new to

26. I often reappraise my experiences during training so I can learn from them.^{a**}
27. When thinking about my training, I often reflect about my strengths and weaknesses.^a
28. I often reflect upon my actions at practice to see whether I can improve them.^{a**}
29. I often think about my past experiences at practice to gain new insights.^a
30. I often reflect about how I can practice things better next time.^{a**}

EFFORT

31. I keep working hard even when sport training tasks become difficult.
32. I put forth my best effort when performing tasks at practice.
33. I concentrate fully when I do a task at practice.^{**}
34. I don't give up at practice even if a task is hard.
35. I work hard at practice on a task even if it is not important.
36. I work as hard as possible on all tasks at practice.
37. Even when I don't like a task during practice, I work hard to do well.
38. If I'm not really good at a task I can compensate for this by practicing hard.
39. If I persist on a task during practice, I'll eventually succeed.^{**}
40. I am willing to do extra practice on tasks in order to acquire more skill.

SELF-EFFICACY

41. I know how to handle unforeseen situations during practice, because I am resourceful.^a

me.

- | | |
|---|--|
| 42. If someone opposes me, I can find means and ways to get what I want. ^{b*} | |
| 43. I am confident that I could deal efficiently with unexpected events. | 43. I am confident that I can deal efficiently with unexpected events at practice. ^a |
| 44. If I am in a bind, I can usually think of something to do. | 44. When I am having troubles during practice, I can usually think of something to do.** |
| 45. I remain calm when facing difficulties, because I know many ways to cope with difficulties. | 45. When facing difficulties at practice I can remain calm because I can rely on my coping abilities. ^a |
| 46. I always manage to solve difficult problems if I try hard enough. | 46. I can always manage to overcome difficulties at practice if I try hard enough.** |
| 47. It is easy for me to concentrate on my goals and to accomplish them. | 47. It is easy for me to concentrate on my goals and to accomplish them at practice.** |
| 48. I can solve most problems if I invest the necessary effort. | 48. I can overcome most challenges at practice if I invest the necessary effort.** |
| 49. When I am confronted with a problem, I usually find several solutions. | 49. When I am confronted with a difficulty during practice, I can usually find several solutions. ^a |
| 50. No matter what comes my way, I'm usually able to handle it. | 50. No matter what comes my way at practice, I am usually able to handle it. |

Note: Although the items are presented herein to show alignment by conceptual scale, items in the survey were randomized when presented to participants to avoid systematic biases in responses.

^aItem reversed back to original subscale wording, from before Toering et al.'s (2012) work, for the sake of improved readability.

^bItem removed in the refined SRL-SRS because pilot ratings consensually demonstrated poor pertinence to athletes in training, and would need to be significantly modified if retained.

*Items removed from Toering et al.'s (2012) SRL-SRS version during factor analysis because of low factor loadings.

**Items removed from our refined SRL-SRS during the iterations of the EFA

Table 2

One-way ANOVA Descriptive Statistics for IAAF Scores for the Six Performance Levels

Performance Levels	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Local	20	262.30	247.410	55.323	146.51	378.09
City	11	291.27	241.472	72.806	129.05	453.50
Regional	23	612.09	211.737	44.150	520.53	703.65
Provincial	20	625.45	221.773	49.590	521.66	729.24
National	38	852.45	163.164	26.469	798.82	906.08
International	8	956.75	148.994	52.677	832.19	1081.31
Total	120	625.70	311.051	28.395	569.48	681.92

Table 3

Rotated Factor Loadings for the Refined SRL-SRS

Items	Factors					
	1	2	3	4	5	6
[Planning] I clearly plan my course of action before starting practice tasks.	.793	.086	-.033	.008	.062	-.032
[Planning] Before practice tasks, I carefully plan my course of action.	.761	.041	-.095	.063	.027	.083
[Planning] I determine how to approach a practice task before I begin.	.610	-.023	-.037	.265	.157	-.207
[Planning] Before I do a practice task, I think through the steps in my mind.	.589	.014	.061	.042	-.078	.220
[Planning] Before practice tasks, I figure out my goals and what I need to do to accomplish them.	.558	.036	.075	-.011	.100	.106
[Planning] I ask myself questions about what a practice task requires me to do before I do it.	.486	.052	.060	-.121	.125	.197
[Planning] I try to understand the goal of a practice task before I do it.	.448	-.079	.205	-.064	.009	.211
[Planning] I develop a plan for resolving difficulties at practice.	.402	.043	.090	.168	-.018	.038
[Effort] I work as hard as possible on all tasks at practice.	.178	.820	-.019	-.114	-.064	-.079
[Effort] I work hard at practice on a task even if it is not important.	.014	.675	-.078	-.067	.052	-.064
[Effort] I put forth my best effort when performing tasks at practice.	.006	.647	.135	.068	.072	-.032
[Effort] Even when I don't like a task during practice, I work hard to do well.	-.023	.591	.079	.172	-.080	.099
[Effort] I don't give up at practice even if a task is hard.	-.101	.590	.079	.029	-.035	.093
[Effort] I keep working hard even when sport training tasks become difficult.	-.139	.532	.083	.133	.166	-.014
[Effort] If I'm not really good at a task, I can compensate for this by practicing hard.	.028	.436	.015	.049	.012	.127
[Effort] I am willing to do extra practice on tasks in order to acquire more skill.	.079	.405	.099	.022	.060	.124
[S-E] When facing difficulties at practice, I can remain calm because I can rely on my coping abilities.	-.015	.004	.717	.044	-.082	.013
[S-E] I am confident that I can deal efficiently with unexpected events at practice.	-.030	.035	.713	.091	.009	-.129
[S-E] I know how to handle unforeseen situations during practice, because I am resourceful.	.125	-.017	.682	-.065	.058	.011
[S-E] No matter what comes my way at practice, I am usually able to handle it.	-.126	.189	.637	-.013	.008	-.064
[S-E] When I am confronted with a difficulty during practice, I can usually find several solutions.	.128	-.025	.590	-.023	.188	.065

[Evaluation] I check my work all the way through a practice session.	.122	-.034	.010	.766	-.067	-.037
[S-M] I check aspects of my workout while doing it.	-.011	.031	.009	.587	-.003	.254
[S-M] I check how well I am doing during practice tasks.	.056	.029	.129	.365	.037	.169
[S-M] While I am engaged in a practice task, I know how much of it I still have to complete.	.012	.130	.017	.336	.123	-.043
[Reflection] When thinking about my training, I often reflect about my strengths and weaknesses.	.001	.008	-.028	-.039	.709	.017
[Reflection] I often think about my past experiences at practice to gain new insights.	.060	.021	.137	.015	.604	.041
[Evaluation] I look back to see if I did the correct procedures at practice.	.178	.061	-.091	.035	-.002	.656
[Evaluation] I look back and check if what I did in practice was right.	.089	.108	-.083	.151	.153	.581
[Evaluation] I double-check to make sure I did practice tasks right.	.120	.117	.044	.061	.057	.528
[Evaluation] After finishing, I look back on the practice task to evaluate my performance.	.100	-.033	-.062	.198	.224	.440
Cronbach alpha	.87	.84	.82	.69	.62	.81
Percent Variance	25.94	10.17	4.95	3.19	2.37	2.15

Note. Factor 1 = Planning; Factor 2 = Effort; Factor 3 = Self-efficacy; Factor 4 = Self-monitoring; Factor 5 = Reflection; Factor 6 = Evaluation

Table 4

Mean and Standard Deviation Statistics and Between Group Differences for Constituent SRL Processes and Composite SRL

	Recreationally Competitive	Less-elite	Elite
Age (in yrs)	26.04 (5.16)	21.04 (3.48)	22.59 (2.88)
Gender (m / f)	36 m / 11 f	76 m / 16 f	88 m / 45 f
Sport specific practice (hrs/wk)	10.04 (6.63)	14.19 (8.53)	14.33 (6.87)
Planning	5.16 (0.98)	5.17 ^c (1.00)	5.49 ^c (1.03)
Self-monitoring	5.61 ^b (0.91)	5.83 (0.83)	6.08 ^b (0.72)
Evaluation	5.25 (1.11)	5.34 (1.15)	5.62 (1.07)
Reflection	5.89 (0.92)	5.88 (0.95)	5.99 (1.01)
Effort	5.63 ^b (0.82)	5.84 (0.77)	6.06 ^b (0.75)
Self-efficacy	5.44 ^b (0.83)	5.50 ^c (0.89)	5.81 ^{b c} (0.85)
Composite SRL	5.49 ^b (0.59)	5.59 ^c (0.65)	5.84 ^{b c} (0.63)

Note: Standard deviations are shown in parentheses. Superscripts indicate between group differences as follows: ^a recreationally competitive different from less-elite, ^b recreationally competitive different from elite, ^c less elite different from elite.

All means for the constituent SRL processes and composite SRL are on a 1-7 scale.

Table 5

Overview Summary of Significant Findings from Multinomial and Binomial Logistic Regression for Both Composite SRL and Constituent SRL Processes

Independent Variable of Interest	Performance Group Comparison	B	SE	Wald	<i>p</i>	Exp (B)
Composite SRL	Elite versus RC**	1.14	.33	11.79	.001	3.15
Composite SRL	Elite versus Less-elite *	.59	.219	7.404	.007	1.81
Independent Variable of Interest	Performance Group Comparison	B	SE	Wald	<i>p</i>	Exp (B)
Self-monitoring	Elite versus RC**	1.01	.31	10.61	.001	2.74
Self-monitoring	Less-elite versus RC**	.81	.31	6.52	.011	2.25

Note: two asterisks represent results from multinomial logistic regressions, while one asterisk represent results from the binomial logistic regressions where all six constituent variables were entered simultaneously. RC = recreationally competitive.

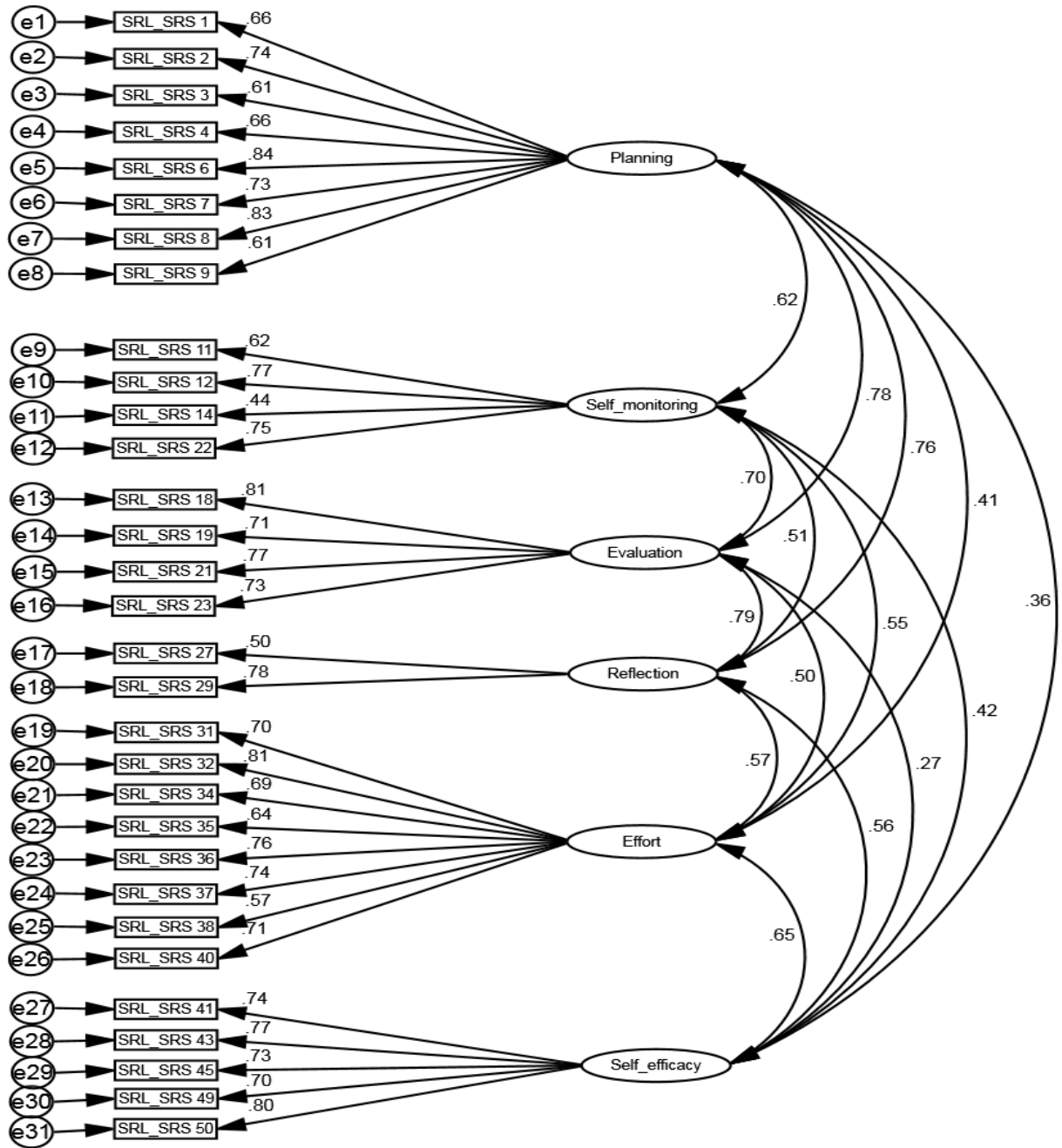


Figure 1. Measurement model diagram and standardized regression weights of items on six latent factors in the refined 31-item SRL-SRS solution.

Chapter 4: The Role of Self-regulated Learning in Deliberate Practice

The theory of deliberate practice (DP) is the main conceptual framework guiding the development of expertise in (Ericsson, Krampe & Tesch-Römer, 1993). It states that the amounts of DP in which individuals engage are directly associated with their level of acquired expertise. There has been support for this framework in sport (Starkes, 2000) where the highest levels of performance appear to require an extensive amount of prior preparation in DP (Ericsson et al., 1993). DP is defined as a highly structured activity that has been found most relevant to improving performance, specifically comprising goal-directed activities that tend to be effortful, not immediately motivating, with no immediate rewards (Ericsson et al., 1993). This means that persistence at DP is unlikely to occur without significant motivation, and athletes' regulation of their motivation to practice.

Importantly, Baker and Young (2014; see also Young & Medic, 2008; Tedesqui & Young, 2015) suggested that optimization of DP may depend on athletes' self-regulation of learning strategies, which would effectively allow athletes to benefit most from their practice. DP activities should be especially beneficial to athletes because they involve the structuring of activities in ways to improve skill acquisition, which require deliberate cognitive processes related to planning, execution, and reflection (Ericsson, Prietula, & Cokely, 2007). Such deliberate cognitive processes epitomize aspects of self-regulated learning (SRL; Zimmerman, 2006). Zimmerman (1998) conceptually described how expert athletes are better able to self-regulate their practice behaviours to negotiate the struggles and diverse challenges that come with DP, which would be particularly important in the pursuit of expert development.

The DP framework is known as being nurturistic in understanding the development of expertise. Although little empirical emphasis has been placed on the role of individual differences in the DP framework, there is some literature suggesting that certain individual differences may

predispose individuals towards more DP. Specifically, there have been suggestions that individual differences in SRL practices may help certain individuals maximize DP (Baker & Young, 2014; Young & Medic, 2008; Zimmerman, 1998). Recent literature proposes that self-regulated learning (SRL) is critical in helping athletes overcome practice constraints toward expertise (Tedesqui & Young, 2015) and involves psychological processes that may help athletes maximize DP (Baker & Young, 2014). More specifically, it was suggested that SRL processes allow developing athletes to make strategic decisions in order to optimize training and to effectively and efficiently balance the needs to practice and recover.

In the little literature that has considered SRL processes in relation to sport training, the conceptualization of various psychological processes has been framed according to Zimmerman's (2006) SRL cycle. This cycle depicts the specific processes that are used to understand how athletes control their behaviours and motivation during practice. In a specific modification for sport, Young and Medic (2008) described how several SRL processes of Zimmerman's cycle are critical for long-term sport skill acquisition and portrayed SRL as a continual cycle of goal setting and strategic planning, self-monitoring, and self-evaluation. Recent survey-based research has used this social cognitive model to assess various key processes of SRL. Specifically, Toering and colleagues (2009, 2012) have used Zimmerman's model to capture some of the processes described by this cycle. They developed the Self-Regulated Learning – Self-Report Scale (SRL-SRS), which assesses four specific SRL processes: planning, self-monitoring, evaluation and reflection, along with two motivational variables – effort and self-efficacy. In earlier sections of this thesis, we have refined this survey to better fit a sport sample (see Manuscript 1) and it will be used in the following chapter.

In light of literature suggesting an important association between various SRL processes and practice, the current study sought to identify the psychological SRL processes that may be

influential for athletes to practice more. That is, it aimed to identify SRL processes that may be key in facilitating athletes to engage in more DP, with specific reference to psychological processes from Zimmerman's (2006) social cognitive model of SRL using the refined SRL-SRS.

A few studies have examined the relationship between SRL and practice amounts. A study with highly skilled musicians examined the relationship between SRL and time spent practicing (Araújo, 2015). Although this study did not employ Zimmerman's SRL model, results still show how some aspects of SRL are associated with daily practice time. Self-regulation through practice organization (e.g., planning of time and order of activities, goal setting) was significantly different between groups exhibiting different practice durations per day. There was a significant increase in the mean levels of self-regulated practice organization from the 'less than 1h' group to the '3h–4h' group. Also, self-regulated efforts to seek information/help from external resources (e.g., teachers, peers, composers, specialists, materials) was significantly different between different practice duration groups, with self-regulated means increasing from the 'less than 1h' group to the '3h–4h' group. In this study, greater engagement in SRL was associated with greater amounts of practice.

Elferink-Gemser et al. (2015) examined the integration of psychological constructs of SRL, motivation, and goal orientation in the context of high level competitive youth sport. One of the specific relationships within their proposed hypothetical model was the correlation between SRL and training volume, which was measured by the average number of training hours per week during the competitive season. Researchers found two specific SRL processes, planning ($r = .25$) and reflection ($r = .24$), which were positively related to training volume. To understand the unique contributions of each SRL process, the six processes need to be considered simultaneously, which was not the case in this study. Therefore, no inferences can be made on which processes might be most important for training volume relative to one another. In addition,

this study did not measure DP, nor did it use a proxy measure of DP to understand relationships with SRL measures.

No study has examined relationships between SRL processes and DP in an adult sport sample. In light of this gap, the general aim of this study was to explore how various processes of SRL are each associated with engagement in DP. In order to contrast our findings for DP, we also explored how SRL was associated with more general forms of physical preparation (PP) activity. DP is defined as a goal directed activity that directly resembles the technical or tactical demands associated with one's main sport. These activities therefore require concentration and intent because they are aimed at improving one's performance (Hopwood, 2013). On the other hand, PP activities are aimed at improving physiological and muscular capacities (e.g., cross-training), and so the engagement of SRL processes may not be important for this type of activity. In light of the fact that self-regulated learning involves athletes being motivationally, behaviourally, and meta-cognitively engaged in their practice context (Zimmerman, 2008), we posited that a number of SRL processes would be significantly associated with DP. Contrarily, we posited that SRL processes would not be associated with PP activities to the same degree as with DP. In light of the different nature of these variables, we expected SRL associations with DP and PP to be different.

For each of DP and PP, we specifically examined how (1) composite SRL and (2) six constituent SRL processes (i.e., planning, self-monitoring, evaluation, reflection, effort, self-efficacy) related to amounts of practice (both composite SRL and the six constituent SRL-SRS processes had been considered previously in Manuscript 1, this thesis).

In addition, associations between SRL processes and each of DP and PP were assessed in four different practice contexts: supervised, unsupervised, social, and non-social. These contexts were derived from Hopwood's (2013) measure in assessing practice amounts. In order to identify

which SRL processes may be most important depending on the practice context, it was important to explore the associations relative to different settings as certain processes may be more important than others when one is practicing with a coach, in a social group, unsupervised or in a non-social settings. Although this study was exploratory, we proposed several hypotheses. First, we expected to find more evidence of SRL processes strongly associated with unsupervised DP in comparison to supervised DP. In addition, we also expected to find evidence to suggest that SRL processes are more strongly associated with DP in non-social contexts compared to social practice contexts. These assumptions were based on previous literature stating that the recruitment of SRL resources or processes may be more critical in the absence of external supports (i.e. a coach or other athletes; Baker & Young, 2014; Young & Medic, 2008).

Methods

Participants

Participants used in this study are the same as described in Manuscript 1 (see p. 36). North American individual sport athletes ($n = 272$) ranging from local to international level (196 male, 70 female; M age = 22.48, $SD = 3.95$, range 18-35; M weekly hours of sport-specific practice = 12.95 hrs, $SD = 6.47$) participated in this study. For the purpose of this chapter, our sample was not treated according to three skill groups, but rather as one collapsed group.

Survey Measures

Participants were asked to complete three different questionnaire segments including: general demographic questions; a refined self-regulated learning in sport questionnaire based on Toering et al.'s (2012) Self-Regulated Learning-Self Report Scale and questions documenting amounts of practice activity in sport derived from the Developmental History of Athletes Questionnaire (Hopwood, 2013).

Self-regulated learning in sport survey. This refined 48-item questionnaire (see Appendix J; see also Manuscript 1, this thesis) is divided into 6 sub-scales including planning, self-monitoring, evaluation, reflection, effort and self-efficacy. Participants were asked to respond to the items as they related to practice tasks in sport training and their sporting environment. Planning, self-monitoring, evaluation and effort items were scored on a 1-7 Likert scale anchored at 1- ‘almost never, 4 – ‘sometimes, and 7 – ‘almost always’. Reflection and self-efficacy items were scored on a 1-7 Likert scale anchored at 1- ‘strongly disagree’, 4 – ‘neither agree or disagree’, and 7 – ‘strongly agree’. A composite SRL score was also used – this was calculated by averaging the scores of each of the subscales above.

Amounts of weekly practice activity. Questions were derived from Hopwood’s (2013) survey for obtaining data in several preparatory activities for one’s primary sport. Our questionnaire (see Appendix I) prompted participants to report amounts for a “typical week” during one’s training season, with specific reference to a week during the competitive season of their main sport that is 10 weeks prior to their major competition. Athletes were prompted to give hours per week in *sport-specific practice* for their main sport in the following four conditions: (1) where a coach is present providing supervision to you and others, (2) a coach is present providing one-on-one supervision only to you, (3) no coach is present to provide supervision but you are practicing with others, (4) no coach is present to provide supervision but you are practicing on your own. These four conditions were combined to yield total weekly amounts of sport-specific practice. Although this survey has never purported to report DP, it represented the best self-report ‘proxy’ for DP available. The nature of the questions allowed us to derive weekly amounts in each of the aforementioned conditions: ‘supervised’ practice (added amounts from conditions 1 + 2), ‘unsupervised’ (conditions 3 + 4), ‘social’ (conditions 1 + 3) and ‘non-social’ (conditions 2 + 4).

Questions for weekly practice for these same four conditions were also asked for *physical preparatory activities* described as activities aimed at improving physiological and muscular capacities such as strength, power, endurance, and flexibility (e.g., strength and conditioning, weights, fitness, pilates, yoga, and flexibility training (Hopwood, 2013). Once again, this approach yielded total amounts of physical preparatory activity, as well as amounts of PP in each of the supervised, unsupervised, social, and non-social practice contexts.

Planned Analyses

The main set of analyses involved regressions to explain variance in amounts of practice activity. Analyses for sport-specific practice were performed separately from analyses for PP. Linear regressions were conducted to determine whether (a) the athlete's composite SRL score, as well as (b) whether the six SRL processes would predict the amount of total weekly practice in which an athlete engages, across all contexts. In addition, we tested to see if regression results would differ based on practice context: supervised, unsupervised, social and non-social by conducting additional linear regressions for (a) composite SRL and (b) constituent SRL processes for sport-specific hours and PP hours in each of the four practice contexts.

Results

Preliminary Analyses

Skewness and kurtosis were inspected for all dependent variables, including total sport-specific hours, total PP hours and sport-specific practice and PP amounts in each of the four practice contexts. All variables were within acceptable ranges indicating normality. In an initial inspection of outliers, six cases with standardized residuals > 3 were removed for sport-specific practice and PP data (Fields, 2005). Furthermore, for total sport-specific practice and PP hours, in both composite SRL and the constituent SRL processes, cases with p Mahalanobis distance < 0.001 or studentized residuals > 3 were marked as outliers and excluded from subsequent

analyses respectively (Fields, 2005). When these latter criteria were applied to regressions with composite SRL as the independent variable, four cases were excluded from the data for total sport-specific practice hours and total PP hours. When these latter criteria were applied to regressions with the six constituent SRL variables as simultaneous independent variables, seven cases were removed from the data for total sport-specific hours and 10 cases for total PP hours. When an outlier was identified in the data pertaining to total sport-specific or PP hours, data for the same participant were removed in subsequent analyses pertaining to the same dependent variable in the four practice contexts. Since correlations between age and sport-specific practice were significant ($r = -.27, p < .01$), age was added as a covariate to linear regression analyses with sport-specific practice.

Primary Analyses to Explain Deliberate Practice and Physical Preparation

Inspection of the sport-specific practice and PP data showed a significant correlation between the two variables, $r = .26, p = .00$. Therefore, in an attempt to more clearly distinguish the two variables, sport-specific practice was replaced with ‘physical preparation-free deliberate practice (‘PP-free DP’) and physical preparation was replaced with deliberate practice-free physical preparation (‘DP-free PP’). PP-free DP was measured as the standardized residual associated with predicting DP from PP. Similarly, DP-free PP was the standardized residual associated with predicting PP from DP. The residuals were calculated and saved from a regression analysis using SPSS, and subsequently used as the new dependant variables. Hereafter, in this chapter, all references to DP and PP pertain to these new dependent variables.

Composite SRL. Using a composite SRL score as the independent variable, a linear regression was performed to explain variance in amounts of DP. Although the model proved significant ($p < .01, R^2 = .07$), no significant results were found between total hours of DP with the composite SRL score ($p = .28$; see Table 1).

Table 1

Summary of Linear Regression Analyses for Composite SRL Predicting DP Hours

		Total DP hours ($p = .00, R^2 = .07$)				
		B	SE (B)	B	t	p
Age		-.059	.014	-.260	-4.33	.000
Composite SRL		-.089	.083	-.064	-.106	.288
		DP supervised ($p = .00, R^2 = .15$)				
		B	SE (B)	β	t	p
Age		-.092	.014	-.375	-6.55	.000
Composite SRL		-.140	.087	-.092	-1.61	.109
		DP unsupervised ($p = .00, R^2 = .05$)				
		B	SE (B)	β	t	p
Age		.054	.015	.224	3.68	.000
Composite SRL		.012	.090	.008	.132	.895
		DP social ($p = .00, R^2 = .16$)				
		B	SE (B)	β	t	p
Age		-.095	.014	-.391	-6.88	.000
Composite SRL		-.140	.085	-.094	-.165	.101
		DP non-social ($p = .00, R^2 = .06$)				
		B	SE (B)	β	t	p
Age		.062	.014	.258	4.30	.000
Composite SRL		.030	.089	.020	.334	.739

*Note: The significance of the model (p) and the variance explained by the model (R^2) are indicated next to each header.

A separate linear regression was performed this time with PP as the dependant variable. The model was non-significant ($p = .07, R^2 = .01$), and no significant results were found between total hours of PP with the composite SRL score (see Table 2; $p = .07$).

We also examined DP and PP hours in four different contexts: (1) under coach supervision, (2) in an unsupervised coaching environment, (3) in a social group and (4) in a non-social context. Although the models were significant for all DP data (all $ps < .01$), no significant results were found with respect to the contribution of the composite SRL variable in regressions for any of the four conditions for DP (all $ps > .10$; see Table 1).

Table 2

Summary of Linear Regression Analyses for Composite SRL Predicting PP Hours

Total PP hours ($p = .07, R^2 = .01$)					
	B	SE(B)	β	t	p
Composite SRL	.159	.087	.112	1.82	.070
PP supervised ($p = .12, R^2 = .00$)					
	B	SE (B)	β	t	p
Composite SRL	.133	.087	.094	1.52	.129
PP unsupervised ($p = .18, R^2 = .00$)					
	B	SE (B)	β	t	p
Composite SRL	.120	.091	.082	1.33	.185
PP social ($p = .25, R^2 = .00$)					
	B	SE (B)	β	t	p
Composite SRL	.100	.087	.071	1.14	.255
PP non-social ($p = .10, R^2 = .01$)					
	B	SE (B)	β	t	p
Composite SRL	.148	.092	.099	1.61	.109

**Note:* The significance of the model (p) and the variance explained by the model (R^2) are indicated next to each header.

Regression models were not significant for PP data (all $ps > .07$) and no significant results were found with respect to the contribution of composite SRL in regressions for any of the four conditions for PP (all $ps > .07$; see Table 2).

Constituent SRL processes. To determine whether athletes' scores on the six constituent SRL processes predict amounts of DP, we performed five multiple linear regression using the six constituent SRL processes as independent variables (i.e., dependent variables in separate analyses were: total DP, and DP in each of the four contexts). Results for total DP hours showed a significant regression equation with age as a covariate, $F(7, 251) = 4.84, p < 0.01, R^2 = 0.11$. More specifically, 'self-monitoring' was the only significant predictor of total DP hours, $\beta = .19, p < .01$. Regarding the four DP contexts, all models were significant (all $ps < .02$). 'Self-monitoring' positively predicted DP hours in supervised, $\beta = .26, p < .01$ and social contexts, $\beta = .26, p < .01$. 'Planning' inversely predicted DP hours in supervised, $\beta = -.18, p = .01$ and social settings, $\beta = -.17, p = .02$. Finally, 'effort' inversely predicted DP hours in supervised settings, $\beta = -.13, p = .04$ (see Table 3).

Table 3

Summary of Multiple Regression Analyses for Constituent SRL Processes Predicting DP Hours

	Total DP hours ($p = .00, R^2 = .07$)				
	B	SE (B)	β	t	p
Age	-.067	.014	-.290	-4.796	.000
Planning	-.061	.074	-.067	-.826	.410
Self-monitoring	.225	.083	.192	2.708	.007
Evaluation	-.003	.072	-.003	-.041	.967
Reflection	.000	.065	.000	-.006	.995
Effort	-.155	.090	-.128	-1.724	.086
Self-efficacy	-.085	.077	-.079	-1.107	.269

DP supervised ($p = .00, R^2 = .15$)					
	B	SE (B)	β	t	p
Age	-.100	.014	-.399	-7.02	.000
Planning	-.182	.075	-.184	-2.43	.016
Self-monitoring	.339	.084	.268	4.03	.000
Evaluation	.003	.073	.004	.046	.964
Reflection	.013	.066	.013	.200	.842
Effort	-.181	.091	-.139	-1.98	.049
Self-efficacy	-.062	.078	-.053	-.791	.429
DP unsupervised ($p = .00, R^2 = .05$)					
	B	SE (B)	β	t	p
Age	.049	.015	.200	3.216	.001
Planning	.151	.080	.158	1.893	.060
Self-monitoring	.003	.089	.002	.032	.975
Evaluation	-.051	.078	-.057	-.661	.509
Reflection	.006	.070	.006	.090	.928
Effort	-.085	.097	-.067	-.879	.380
Self-efficacy	-.073	.083	-.065	-.885	.377
DP social ($p = .00, R^2 = .16$)					
	B	SE (B)	β	t	p
Age	-.103	.014	-.413	-7.338	.000
Planning	-.167	.074	-.171	-2.268	.024
Self-monitoring	.335	.083	.266	4.044	.000
Evaluation	-.027	.072	-.029	-.374	.709
Reflection	.056	.064	.056	.874	.383
Effort	-.166	.090	-.128	-1.847	.066
Self-efficacy	-.112	.076	-.097	-1.470	.143
DP non-social ($p = .00, R^2 = .06$)					
	B	SE (B)	β	t	p
Age	.057	.015	.234	3.797	.000

Planning	.137	.078	.144	1.749	.082
Self-monitoring	-.028	.088	-.023	-.317	.751
Evaluation	.016	.076	.018	.214	.830
Reflection	-.046	.068	-.048	-.678	.498
Effort	-.105	.095	-.084	-1.100	.272
Self-efficacy	-.012	.081	-.011	-.148	.883

**Note:* The significance of the model (p) and the variance explained by the model (R^2) are indicated next to each header.

In comparison, we also wanted to determine whether DP differed from PP when regressed upon the SRL predictor variables. Therefore, we performed multiple linear regressions using the six constituent SRL (simultaneous) scores as independent variables separately for five dependent variables (i.e., total PP hours and PP amounts in each of the four different conditions). Results for total PP hours showed a significant regression equation, $F(6, 249) = 6.12, p < 0.01$, with $R^2 = 0.12$. Models were also significant for all four practice contexts, all $ps < .01$. More specifically, ‘self-monitoring’ was inversely predictive of total PP hours, $\beta = -.30, p > .001$, as well as in the four contexts: supervised $\beta = -.26, p < .001$, unsupervised $\beta = -.21, p < .01$, social $\beta = -.29, p < .01$, and non-social $\beta = -.15, p = .039$. In addition, ‘effort’ positively predicted total PP hours, $\beta = .26, p < .01$, as well as in the four contexts: supervised $\beta = .22, p < .01$, unsupervised $\beta = .18, p < .01$, social $\beta = .21, p = .017$ and non-social $\beta = .18, p = .013$. Moreover, within an unsupervised context, reflection was inversely associated with PP hours, $\beta = -.14, p = .047$. Self-efficacy was a positive predictor of PP hours in both unsupervised, $\beta = .16, p = .026$, and non-social, $\beta = .15, p = .032$ practice contexts (see Table 4).

Table 4

Summary of Multiple Regression Analyses for Constituent SRL Processes Predicting PP Hours

Total PP hours ($p = .00, R^2 = .12$)

	B	SE (B)	β	<i>t</i>	<i>p</i>
Planning	.083	.075	.091	1.102	.272
Self-monitoring	-.349	.081	-.305	-4.319	.000
Evaluation	.031	.072	.036	.426	.671
Reflection	-.086	.064	-.093	-1.340	.182
Effort	.311	.086	.264	3.608	.000
Self-efficacy	.129	.075	.121	1.717	.087
PP supervised ($p = .00, R^2 = .08$)					
	B	SE (B)	β	<i>t</i>	<i>P</i>
Planning	-.017	.076	-.018	-.219	.827
Self-monitoring	-.296	.081	-.262	-3.634	.000
Evaluation	.116	.072	.138	1.605	.110
Reflection	.018	.065	.020	.280	.780
Effort	.257	.087	.222	2.963	.003
Self-efficacy	.014	.075	.014	.189	.850
PP unsupervised ($p = .00, R^2 = .09$)					
	B	SE (B)	β	<i>t</i>	<i>p</i>
Planning	.150	.078	.161	1.923	.056
Self-monitoring	-.251	.084	-.215	-2.998	.003
Evaluation	-.060	.075	-.069	-.801	.424
Reflection	-.133	.066	-.141	-2.000	.047
Effort	.215	.089	.180	2.411	.017
Self-efficacy	.173	.077	.161	2.233	.026
PP social ($p = .00, R^2 = .09$)					
	B	SE (B)	β	<i>t</i>	<i>p</i>
Planning	.009	.078	.009	.110	.913
Self-monitoring	-.341	.083	-.294	-4.089	.000
Evaluation	.111	.074	.129	1.496	.136
Reflection	-.031	.066	-.033	-.461	.646
Effort	.257	.089	.216	2.892	.004
Self-efficacy	.034	.077	.032	.442	.659

	PP non-social ($p = .00$, $R^2 = .08$)				
	B	SE (B)	β	t	p
Planning	.122	.080	.128	1.519	.130
Self-monitoring	-.178	.086	-.150	-2.070	.039
Evaluation	-.082	.077	-.093	-1.075	.283
Reflection	-.101	.068	-.105	-1.473	.142
Effort	.229	.092	.188	2.497	.013
Self-efficacy	.171	.080	.156	2.153	.032

**Note:* The significance of the model (p) and the variance explained by the model (R^2) are indicated next to each header.

Discussion

The overarching purpose of this study was to determine the psychological self-regulated learning processes that may be associated with athletes' engagement in DP (i.e., activities aimed at improving one's performance, that resembled the technical and tactical elements of one's main sport) and PP (activities aimed at improving one's muscular and physiological capacities, such as cross-training). As such, this study covered many specific objectives. We wished to determine how (1) overall engagement in SRL processes, and (2) each of the six constituent SRL processes, were associated with total amounts of DP and PP in various practice contexts. This is one of few studies that has examined the relationship between SRL and amounts of DP and the only study that specifically examined how this relationship may vary in different practice contexts.

Our findings demonstrated no association between composite SRL and total hours of DP, as well no association in different practice contexts. Similarly, no association was found between composite SRL and total PP hours, as well as in the different practice contexts. We posit that that non-significance of these results could be attributed to the nature of the composite SRL score which is composed of six different SRL processes. From the results for the constituent SRL

processes, we recognize that different SRL processes are associated in opposite directions (i.e., self-monitoring results are positive for DP, meanwhile, planning and effort processes are negative for DP). It could be the case, that because these processes are opposed, they attenuate composite SRL results. The same reasoning can be applied to the results pertaining to PP – self-monitoring is positively associated with PP, while effort is negatively associated. Another postulation for non-significance of composite SRL results is that results from our previous study suggested that elite athletes rely more heavily overall on self-regulated learning in their practice behaviours, a discriminating feature of elite athletes (see Manuscript 1, this thesis). It is possible that since only elite athletes hold this SRL advantage, it may only be significant for this specific athlete group and not evident when elite, less-elite and recreationally competitive athletes were collapsed as they were in the present analyses. Future research should further explore this hypothesis.

Researchers have speculated that self-regulated learning processes allow developing athletes to make strategic decisions in order to optimize training and overcome constraints associated with DP (Young & Tedesqui, 2015). Therefore, we examined more specifically which constituent SRL processes are associated with greater amounts of DP. Our results revealed that self-monitoring was the only predictor of total DP hours. It was also positively associated with DP in supervised and social settings. This suggests that self-monitoring may be an important aspect for greater engagement in overall DP hours. In fact, contrary to our hypotheses, self-monitoring may be especially pronounced in the presence of a coach or when training with other athletes. We suggest that social regulation may play a role in such settings. Social regulation refers to regulation involving others and can take the form of co-regulation, whereby someone prompts and supports learners' self-regulation, or shared regulation, whereby groups engage in regulatory processes as a unit (Järvelä & Hadwin, 2013). In supervised settings, for example when a coach is present, there may be co-regulation between the coach and the athlete whereby

the coach can support, influence, or prompt the athlete's regulation processes, beliefs, goals, etc. Additionally, the athlete may have expectations of knowing that the coach will ask them about what they are thinking and ask questions about their practice tasks, therefore, athletes would be more likely to self-monitor in such situations. Successful collaboration between the coach and the athlete, requires individuals to actively monitor and regulate each other through questioning, prompting, and restating (Järvelä & Hadwin, 2013), therefore, athletes may report self-monitoring more frequently. In social settings, shared regulation may play a role, which occurs when groups regulate as a collective such as when they construct shared task perceptions or shared goals (Järvelä & Hadwin, 2013). Without shared task representations and shared goals, collaborative work may become disrupted or less satisfying for learners resulting in less effective, efficient, and/or less enjoyable learning (Hadwin, Järvelä & Miller, 2010). Perhaps with this shared regulation, there is a greater enjoyment of learning or better outcomes of practice, which may lead athletes to engage in more DP. However, without first self-monitoring, an athlete may not be able to contribute to shared task representations and shared goals. Therefore, one can argue that a coach or a social environment may be facilitating or requiring athletes' self-monitoring and deliberate practice.

Additionally, we found planning to be inversely associated with DP only in supervised and social settings. This might also be explained by the presence of a coach or other individuals – athletes would not need to plan ahead to the same extent because other individuals (i.e., a group leader or coach) have likely already done this for them. For example, a coach may plan the practice ahead of time, therefore leaving little/no opportunity, or no expectation for planning practice tasks on the part of the athletes. In other words, when athletes report higher amounts of DP in the presence of a coach or social group, they are also likely to report less planning.

Unexpectedly, our final results for DP showed effort being inversely associated with DP in supervised settings. This suggests that athletes who report high levels of engagement in hard physical work may also report engaging in less amounts of DP in the presence of a coach. However, past research has proposed that DP is characterized by demands for cognitive effort (i.e., concentration) rather than an engagement in hard physical effort (e.g., Hodges & Starkes, 1996). Yet, when considering the items comprising the effort subscale, all the items represent physical effort with no focus on cognitive effort. Additionally, we observe that the two highest loading items are “I work as hard as possible on all tasks at practice” and “I work hard at practice on a task even if it is not important” (see Table 2, Manuscript 1, this thesis). One might argue that these items do not encompass the broader definition of effort and DP. One might put effort towards DP, but this does not include all tasks, and especially unimportant tasks. As stated by Ericsson and colleagues (1993), DP is a structured activity that is highly relevant for improving performance, and therefore would not include all tasks nor unimportant tasks. These explanations may account for what may seem like counterintuitive or contradictory results.

No other SRL processes were associated with DP in the current study, which differs from a similar study by Elferink-Gemser and colleagues (2015). In their study of 63 competitive youth speed skaters ($M_{\text{age}} = 15.73$, $SD = 2.36$), using the same six SRL processes (Toering et al., 2012), planning and reflection were positively related to training volume measured by the average number of training hours during a competitive season. However, they did not any steps to assess DP or even a proxy measure of DP (e.g., sport-specific). In the current study, the same processes were not found to be associated with DP, therefore, more research on these relationships will need to be done to conclude any final results.

To contrast these findings for DP, the same analyses were performed with PP as the dependent variable. We find contrasting results for both self-monitoring and effort. These two

SRL processes were predictive of total PP hours, however they had opposite relationships with respect to DP results. Self-monitoring was inversely associated with total PP and PP in all four practice conditions suggesting that regardless of the training context, self-monitoring may not play a role in the engagement of greater PP, and that too much self-monitoring may be associated with less training in physical preparatory activities. Whereas effort was inversely associated with supervised DP, it was positively associated with total PP and PP in all contexts.

The contrast between DP and PP results may relate to differences in the nature of practice between these two variables, particularly if we assume that our ‘PP-free DP’ is a proxy measure of DP, and that our ‘DP-free PP’ measure is divested from structured, deliberate technical and tactical elements in practice. For example, there is literature attesting that DP requires much more attention to cognitive online processes compared to exclusively physical preparatory activities, especially because the latter activities are largely aimed at improving mobility as well as physiological capacities and general strength (e.g. weight training; Hopwood, 2013); thus, self-monitoring may not be as important in PP training and that too much self-monitoring may be associated with less training in physical preparatory activities. In DP, one needs to be particularly aware of their behaviours in order to be able to engage in other SRL processes such as evaluation and reflection (Young & Medic, 2008). On the contrary, during cross-training activities, an athlete might not wish to be concerned with engaging online cognitive processes as it is a means to an end in order to improve flexibility or gain muscle strength for their main sport. With respect to effort, distinctions between physical and cognitive effort seem to be very important. In terms of PP activity, involving predominantly general strength or endurance training, it is likely that negotiation of physical effort demands are important in almost every training context to maximize amounts of engagement. Yet, DP by its very nature demands more of a cognitive effort rather than necessarily engaging in hard physical effort. Although Ericsson et al. (1993) noted

domains where deliberate practice draws on both physical and mental resources, and Young and Salmela (2002) suggested that DP in sport be determined as requiring physical and/or mental effort, our results point to the need to examine distinctions between physical and mental practice a little bit more fully to understand DP. Results from our study indicate that SRL processes around physical effort (at least as they are assessed in the refined SRL-SRS survey) may not be a critical factor associated with more deliberate practice. On the other hand, PP may be characterized generally as requiring more physical effort. Future research should investigate the role of cognitive effort such as concentration to account and confirm these differences. For example, one may consider adding a new sub-scale measuring concentration to the refined SRL-SRS.

There was also an inverse association between reflection and PP in unsupervised practice contexts. This result suggests that reflection may not be an important factor for the engagement of PP, and that too much reflection may be associated with less training in physical preparatory activities. As earlier, similar reasoning can be brought here: one might not need to reflect on technical and tactical demands, nor on personal strengths and weaknesses during tasks involving cross-training, weight training, or general preparatory activity, because the training demands are not specific to the perceptual-cognitive and decision-making demands associated with performance in one's sport. This explains the inverse association with amounts unsupervised PP, however, it is somewhat surprising that the same explanation cannot be applied to complementary associations between self-reflection and DP (where the demands for reflection might be expected to be higher) because these relationships all proved non-significant. In fact, our reflection subscale lacks adequate reliability, and therefore an absence of significant findings in that subscale could be related.

Finally, self-efficacy was positively related to PP in unsupervised and non-social settings. This suggests that self-efficacy may be an important aspect for physical preparatory training in the absence of a coach and/or other athletes. One may need to have the ability to enhance one's confidence to overcome challenges when there is no one else to rely on, particularly when it comes to training of a predominantly physically effortful nature.

In sum, our results point to self-monitoring overall being an instrumental process associated with amounts of DP and may be important for athletes looking to acquire more DP. Results show different processes may be more important depending on the practice context and depending on the type of practice in which one engages (i.e., deliberate practice vs physical preparation). In fact, an understanding of SRL processes in relation to various training contexts may be an effective approach for characterizing select activities as DP compared to other more-general training activities.

Our current study is subject to a few limitations. As such, we acknowledge that there may be a sampling bias as our female group is significantly more elite than the males. Future research ventures should include testing our study hypotheses on only an elite group to gain a better understanding of how certain SRL processes within an elite group may increase DP amounts. Based on our previous findings (see Manuscript 1, this thesis) where athletes who reported self-monitoring more frequently were more likely to be in higher skill groups, we expected self-monitoring to also be important for the engagement of DP in unsupervised and non-social settings – however, this was not the case. Future research should investigate the role of self-monitoring in such contexts. This may be due to the way we measured DP in our survey; therefore, researchers may consider measuring the ratings of DP during an in-situ practice session (e.g. Coughlan, Williams, McRobert, & Ford, 2013), as surveys may not capture all aspects of DP, nor does our survey address differences in the quality or efficiency of the DP engaged in.

Chapter 5: The Consideration of Future Consequences

In sport, it has been suggested that CFC may be a variable that differentiates peoples' ability to self-regulate and assists in the maximation of rigorous practice (Barone, Maddux, & Snyder, 1997). Hence, it may be an interesting variable to consider which may have a bearing on the relationship between SRL and DP in sport. The purpose of the current chapter was to explore whether the association between SRL and sport-specific practice may be more significant for athletes holding varying degrees of a future-oriented perspective, as captured by the CFC variable.

The CFC variable refers to the extent that people consider, and are influenced by the distal outcomes of their current behaviours (Joireman et al., 2006). CFC has been considered a unidimensional construct, where at one end of a continuum, higher scores reflected high consideration of the long-term future outcomes of one's current behaviours, and on the other end, lower scores reflected a lack of consideration of possible future consequences (Joireman et al., 2006). Studies indicate that individual differences in CFC predict a range of behaviours predictive of self-control and ones' ability to self-regulate (Joireman, 1999; Joireman, Anderson, & Strathman, 2003; Joireman, Shaffer, Balliet, & Strathman, 2012; Strathman et al., 1994). More specifically, a study in the academic domain has shown that higher scores on CFC were associated with higher grades and goal attainment (Joireman, 1999); the inference from such a finding was that CFC helps students better control their study habits and preparation. Furthermore, in the exercise domain, research has shown CFC as a significant moderator of the relationship between scheduling, barriers, relapse prevention, and problem solving self-efficacy and exercise attendance (Woodgate, 2005). A similar moderating influence is of interest in the current chapter where we consider CFC as a moderating influence of the association between

aspects of self-regulation and amounts of practice/preparation in sport, which is a novel area of analysis as no published studies pertaining to CFC have examined the sports domain.

More recently, multiple studies have provided support for CFC as a two factor model: CFC- Future (CFC-F) and CFC-Immediate (CFC-I; Arnock, Milfont, & Nicol, 2014; Joireman, Kees, & Sprott, 2010; Petrocelli, 2003; Rappange, Brouwer, & van Exel, 2009). CFC-F is the extent to which an individual considers the future consequences of their behaviours, whereas CFC-I refers to the extent that an individual considers the immediate consequences of their behaviours. Distinctions between CFC-I and CFC-F are evident in studies relating to exercising and health behaviours. Exercising behaviours were predicted by CFC-F, but not CFC-I in undergraduate students (van Beek et al., 2013). CFC-F was associated with healthier behaviours (e.g., exercise) whereas CFC-I was associated with unhealthier behaviours (e.g., poor eating habits). It was shown that the relationship between CFC-F and exercise attitudes and intentions was mediated by a promotion orientation (i.e., an orientation that facilitates achieving ideal goals by focusing on achieving positive outcomes), yet this was not so for CFC-I in university students (Joireman et al., 2012).

We suggest that athletes higher in CFC-F may be able to better connect the long-term outcomes (to which many competitive athletes aspire) with current training behaviours. Specifically, the capability of making this metacognitive temporal connection between future outcomes and present efforts may have a bearing on the relationship between SRL processes and how much practice one completes. Athletes who are able to make this temporal connection may be more inclined to stay engaged in their current sport training. That is, if athletes consider the future, rather than immediate, consequences of their actions, they may be more likely to engage in SRL processes such as planning, self-monitoring, evaluation, reflection, effort and self-efficacy to do more practice.

The main purpose of this chapter is to present analyses that explored whether the influence of SRL on sport-specific practice depends on individual differences in CFC-F and CFC-I. By exploring this relationship, we may further our understanding of whether certain individuals high in CFC may be more likely to use their SRL skills to engage in higher amounts of practice. In pursuing this main purpose, first, we sought to verify the two factor structure of CFC-14 in a North American individual-sport sample. This was important because the two factor scale has not yet been validated in a sport domain. Second, we wished to examine the moderating role of CFC on (a) the relationship between composite SRL and sport-specific practice, and on (b) the associations between constituent SRL processes and sport-specific practice. More specifically, we wished to determine if aspects of SRL were more strongly related to practice for athletes higher in CFC-F.

Methods

Analyses described herein are related to the same participants as described in Manuscript 1 (see p. 36) and have already been described in the survey and ethics procedures in Chapter 3 (see p. 20). 266 North American individual sport athletes (196 male, 70 female; $M_{\text{age}} = 22.48$, $SD = 3.95$, ages 18-35) participated in the study. However, unlike analyses describes in Manuscript 1, our sample was not treated according to three skill groups, but rather as one collapsed group for the purpose of this chapter (see Table 1).

Survey measures included four different self-report questionnaire segments including: general demographic questions; questions about performance level in one's primary sport; the adapted Self-Regulated Learning-Self Report Scale (see Manuscript 1, this thesis) and questions documenting amounts of sport-specific practice and physical preparation activities in sport derived from the Developmental History of Athletes Questionnaire (Hopwood, 2013). In an attempt to clearly distinguish sport-specific practice from cross-training and physical

preparation, a new sport-specific variable entitled *physical preparation-free deliberate practice* (PP-free DP) was created by removing the variance explained by physical preparation in the DP measure.

Table 1

Descriptive Statistics and Mean Levels for Age, Sport-Specific Practice, CFC-F and CFC-I According to Skill Group and for the Collapsed Sample.

	Recreationally			Three groups collapsed
	Competitive	Less-elite	Elite	
Age (years)	26.15 (5.16)	20.37 (3.48)	22.11 (2.87)	22.48 (3.95)
Gender (m / f)	35 m / 11 f	73 m / 15 f	88 m / 44 f	196 m / 70 f
Sport-specific practice (hrs/week)	9.33 (4.50)	13.11 (6.89)	14.11 (6.36)	12.95 (6.47)
CFC-F	5.26 (1.03)	5.24 (0.93)	5.44 (0.88)	5.35 (0.93)
CFC-I	3.19 (1.28)	3.25 (1.18)	3.24 (1.09)	3.23 (1.15)

Note: Standard deviations are shown in parentheses. CFC was measured on a 1-7 Likert scale.

Additionally, athletes completed the CFC-14 scale (Joireman et al., 2012), comprising the CFC-F and CFC-I subscales. Fourteen items were used to assess the extent to which participants consider their current behaviour with respect to distant outcomes, or more immediate outcomes (see Appendix K for breakdown of the items). This newer CFC 14-scale questionnaire was chosen over the original CFC-12 scale as it has two additional future-oriented items giving an equal number of questions assessing both factors. Items 1-7 assess the CFC-F factor, which is defined as the extent that an individual considers the future consequences of their actions. Items 7-14 assess the CFC-I factor, which is the extent that an individual considers the immediate

consequences of their actions. Participants responded to questions on a 1-7 Likert scale anchored at 1 – ‘not at all like me’ and 7 – ‘very much like me’.

Analyses and Results

CFC-14 Factor Structure

It was important to first check the factor structure and reliability of the CFC-14 scale (CFC-F and CFC-I) with our sample as it has not been previously used or validated in sport. Examination of confirmatory factor analysis (CFA) indices was completed using AMOS software on a measurement model representing the two factors from the CFC 14-scale (Tabachnick & Fidell, 2013). Results revealed a two factor structure with a measurement model showing adequate fit (Hair, 2010): CFI = .944, SRMR = .055, RMSEA = .060 (90% CI = .045 – .074), and $\chi^2/df = 1.96$. In addition, all loadings for individual items on their respective latent factor were .5 or above with the exception of 1 item (see Figure 1).

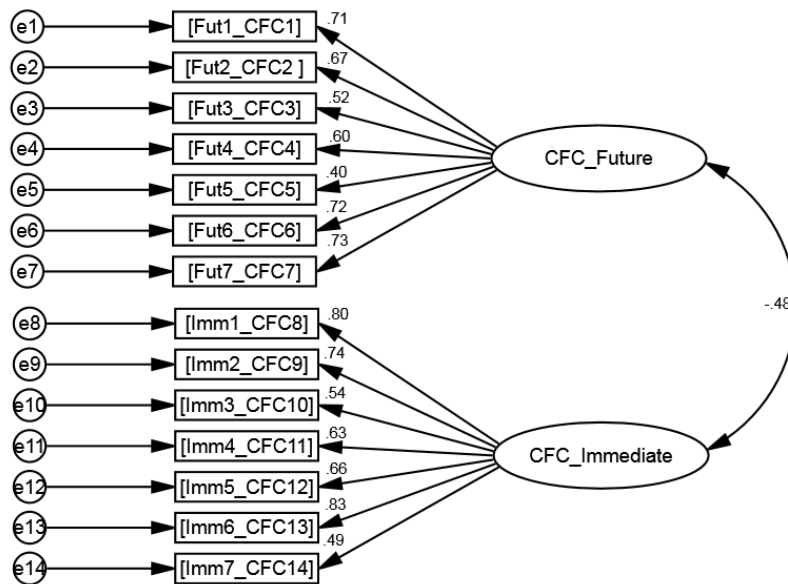


Figure 1. Results for the measurement model diagram showing standardized regression weights of items on the two latent factors of the CFC-14.

Modification indices were inspected for potential cross loadings, and no problematic items were present. Cronbach's alphas were computed to verify the internal consistency reliability of the two scales. Values were .81 and .85 for the CFC-F and CFC-I scales, respectively, representing good reliability (Nunnally, 1978). Prior to use in subsequent analyses, CFC-F and CFC-I were checked for normality. Skewness and kurtosis values ranged between -0.5 and 0.7, indicating acceptable normality in the data.

CFC as a Moderator

To determine if the influence of *composite* SRL, as well as the *constituent* SRL processes, on sport-specific practice (i.e. PP-free DP) depends on levels of CFC, moderating analyses were performed using a series of hierarchical regression analyses. First, median splits were calculated for each of the distributions for CFC-F and CFC-I; in both cases, lower than median and higher than median values were recoded as a low or high category in each of these new variables. With this complete, we proceeded to the first analysis where amounts of sport specific-practice were regressed on composite SRL with CFC-F (low, high) as a moderating variable. In a separate analysis, similarly, amounts of sport-specific practice were regressed on composite SRL with CFC-I (low, high) as a moderator. Next, amounts of sport-specific practice were simultaneously regressed on constituent SRL scores with CFC-F as a moderator. Finally, amounts of sport-specific practice were simultaneously regressed on constituent SRL scores with CFC-I as a moderator. In each analysis of the regression analyses for the constituent SRL processes, only one SRL process was examined for both conditional and interaction effects, while the remaining five SRL processes were inserted simultaneously and examined for conditional effects only.

All steps followed guidelines for interaction analyses for moderating variables (Cohen, Cohen, West & Aiken, 2003), employing the PROCESS macro add-on (Haynes, 2013) for SPSS (Fields, 2005). Entered into the PROCESS macro were: age and gender as covariates in all

analyses, the centered independent variable(s) (i.e., either the lone composite SRL variable, or the six constituent SRL variables depending on the analysis), the dependent (i.e., sport-specific practice), and moderating variable (e.g. either CFC-F or CFC-I). After entering all variables into PROCESS, the macro centered all independent variables and computed the interaction term. The macro provides results for the final block of the hierarchical regression analyses in a traditional moderating analysis, which is the block containing the potential interaction effects above any main/conditional effects in earlier blocks in the hierarchy (Cohen et al., 2003). The macro provides results output for the model in the final block, including: the p value of the full model, the R^2 increase attributed to the final block, p value to indicate whether the R^2 increase is statistically significant, as well as beta weights and p values attributable for each of the independent variables and the interaction term. It also provides the conditional effects in groups defined by levels (low, high) of the moderator variable (i.e., test of simple slopes). For example, when amounts of sport specific-practice were regressed on composite SRL with CFC-F (low, high) as a moderating variable, the output showed conditional effects for age, gender, composite SRL, the conditional/main effect for CFC, and the interaction term for the interaction between SRL and levels of CFC (i.e., SRL*CFC; see table 1 in Appendix P). To be able to discuss significant moderating effects, we looked for a significant change in the total R^2 explained in the model. If the increase in total R^2 explained was significant, then we planned to inspect whether the p value for the interaction term was significant. If a significant interaction term was identified, we planned to check the test of simple slopes to confirm the direction of the moderation.

For each separate analysis, the change in R^2 was inspected in the final block output from the PROCESS macro to see if there was a significant change in the regression model containing the interaction term. The outputs for the final block for each of the regression analyses are

provided in Appendix P of this thesis. Table 2 displays a summary of these results in a manner that allows inspection, across all of the analyses, of the statistical significance of the models, the change in R^2 attributed to the final block in each model, and the significance of the key interaction terms.

Table 2

Summary of Each of the Moderating Analyses for how CFC-F and CFC-I Interacted with Self-Regulated Learning Variables to Predict Sport-Specific Practice.

	CFC-F				CFC-I			
	Model R^2	Model ΔR^2	B	p ΔR^2	Model R^2	Model ΔR^2	B	p ΔR^2
Composite SRL*CFC	.08	.006	-.25	.18	.08	.003	.18	.32
Constituent SRL processes								
Planning *CFC	.12	.007	.17	.14	.11	.002	.10	.35
Self-monitoring*CFC	.11	.003	.14	.31	.12	.006	-.20	.17
Evaluation *CFC	.11	.004	.12	.28	.11	.003	-.10	.35
Reflection *CFC	.11	.001	.06	.59	.11	.000	-.04	.69
Effort *CFC	.11	.001	.11	.47	.11	.002	-.13	.40
Self-efficacy *CFC	.11	.001	.09	.50	.11	.001	-.10	.46

Note. All moderating analyses controlled for age and gender. In each analysis of the regression analyses for the constituent SRL processes, only one SRL process was examined for both conditional and interaction effects, while the remaining five SRL processes were inserted simultaneously and examined for conditional effects only.

No changes in R^2 were found to be significant in either of the composite SRL models, nor for any of the models reflecting interaction terms for each of the specific constituent SRL

processes (all $ps > .14$). This was the case for all of the analyses, where both CFC-F and CFC-I were inspected as separate moderating variables (see Table 2). Therefore regardless of one's consideration of future or immediate consequences, CFC did not affect the relationship between SRL and DP.

CFC Correlations

Since neither CFC-F nor CFC-I were found to significantly moderate relationships between SRL and DP, we inspected to see if there were any significant correlations between each of CFC-F and CFC-I, and SRL measures (see Table 3)

Table 3

Pearson Correlations Between Each of CFC-F, CFC-I and SRL Measures

	Composite SRL	Plan	SM	Eval	Ref	Effort	SE	Sport- specific practice
CFC-F	.35**	.27**	.19**	.27**	.21**	.25**	.24**	-.05
CFC-I	-.16**	-.11	-.08	-.12*	-.03	-.17**	-.14*	.11

Note: * $p < .05$, ** $p < .01$

Results showed that each of the six constituent SRL processes, as well as composite SRL, were positively and significantly correlated with CFC-F as follows: composite SRL $r = .35$, planning $r = .27$, evaluation $r = .27$, effort $r = .25$, self-efficacy $r = .24$, reflection $r = .21$ and self-monitoring $r = .19$ (all $ps < .01$; see Table 3). Therefore, athletes who more highly reported that they consider the distal future consequences of their current behaviours tended to report engaging in more overall SRL and specific constituent SRL processes. On the other hand, effort $r = -.17$, composite SRL $r = -.16$, self-efficacy $r = -.14$ and evaluation $r = -.12$ were each significantly and negatively correlated with CFC-I (all $ps < .038$; see Table 3). Therefore athletes

who more highly reported putting focus on immediate rewards and gratifications also reported less engagement in the said processes.

Discussion

The CFC-14 scale, with its two subscales, showed good factor structure and model fit and our results showed preliminary support for the factor structure of this instrument in sport. The ultimate purpose of this study was to examine CFC as a moderator of the relationship between SRL and DP, however results revealed no significant moderating relationships. Therefore, whether an individual considers the distal future consequences of their current behaviours may not have an impact on the association between SRL and amounts of DP.

A few reasons can be advanced as to why the results did not confirm our hypotheses. We surmise that the non-significant results are not due to measurement issues related to the CFC-F and CFC-I. Although steps were taken to ensure a more valid indicator of DP by removing the variance explained by physical preparation (see chapter 4), this measure could still be inaccurate in that it may encompass more global training hours. Thus, it is possible that associations may have been significant had a more valid measure of DP been used. All things considered, another plausible explanation may simply be that CFC does not influence the relationship between SRL and DP, at least in terms of how SRL was assessed in the current investigation.

Results from the correlations between CFC-F/CFC-I and SRL show that athletes who consider the distal future consequences of their current behaviours seem to engage in higher amounts of SRL processes as they relate to their day-to-day training. More specifically, those athletes who say they are more future-oriented also report more frequently planning tasks ahead of training, the self-monitoring of on-line processes during practice, greater evaluation of their practice tasks, more frequently reflecting back on their training tasks, and putting more effort

towards task execution when training tasks become increasingly demanding, and also report higher self-efficacy and better coping mechanisms in the face of difficult training. On the contrary, athletes who consider the immediate, rather than the future consequences of their actions, tend to engage in less evaluation, invest less effort towards tasks, and have lower self-efficacy to remain resilient when practice tasks become difficult. As athletes report greater consideration of immediate consequences, they also tend to say they self-regulate less overall.

Our results may suggest that CFC is more likely be an antecedent to SRL rather than a moderator of the relationship between SRL and practice, therefore only impacting one's ability to self-regulate. This may be a plausible explanation considering previous studies indicate that individuals high in CFC-F are more inclined to engage in behaviours related to SRL. High levels of CFC-F are positively correlated with other indicators of effective self-control, including conscientiousness and delay of gratification (Strathman et al., 1994) and negatively correlated with impulsivity (Joireman, Anderson, & Strathman, 2003), which is a correlate of ineffective SRL.

In sum, our results suggest that athletes who have a high consideration of future outcomes may be more likely to use SRL strategies during practice, however this high consideration does not have an impact on the amounts of training that an athlete will engage in. On the other hand, it may be difficult for athletes high in CFC-I to remain motivated, and presently engaged in SRL processes when desired/gratifying outcomes are delayed and uncertain (Zimmerman, 2006).

If athletes consider the future consequences of their actions, they may be more likely to engage in various SRL processes, as shown in this study. And based on prior results in this thesis (see Chapter 4), there is evidence that certain SRL processes may then translate into greater amounts of DP. Thus, it could be proposed that athletes higher in CFC-F may be able to anticipate and temporally connect their current behaviours with the delayed gratification and

delayed rewards associated with DP, in such a way to presently engage in more DP. However, this proposition may necessarily depend and would be especially the case for athletes who are able to self-regulate their practice behaviours. Hence, future research should examine the possible role of SRL as a mediator of CFC-F to DP. We recognize that this proposition is somewhat tenuous considering that a direct relationship between CFC-F and DP must first and foremost be present to test for mediation (Fields, 2005), which was not the case in the present study.

Conclusion

This research has shown preliminary support of factor structure for the CFC-14 in sport. Given the exploratory nature of the current research on one sample, future research is critical to conduct further confirmatory factor analyses for replication on additional sport samples. Additionally, this was the first study that considered CFC as an individual difference variable in relation to SRL in sport. Although we found an association between CFC and SRL (both composite and constituent processes) we cannot conclude any causal links between these two variables. Since we used a cross-sectional study design, future research should consider a longitudinal study to account for some of the limits of this study. Although results showed that CFC is a non-significant moderator of the relationship between SRL and DP, future research questions have been raised for the role of CFC in sport and its relationship with SRL and DP. In sum, CFC seems to be an individual difference variable affecting individual sport athletes' engagement in various aspects of SRL of sport training

Chapter 6: General Discussion

Overall, the primary interests of this thesis were to: (1) validate a sport-specific self-regulated learning (SRL) survey measure and to use the measure to determine how composite SRL and constituent SRL processes are associated with different skill levels, (2) examine how these SRL processes are associated with engagement in deliberate practice (DP), and (3) explore whether the individual difference variable ‘consideration of future consequences’ (CFC) may play a moderating role in the interaction between SRL and DP. As such, the following chapter begins by providing a summary of the findings of each of the three studies comprising the current research. Second, the chapter discusses various methodological and theoretical strengths, limitations, and areas for future research. Finally, we conclude by highlighting the potential practical implications that this research may have for coaches, athletes, athletic directors and curriculum designers.

Summary of Studies

Study 1 (Manuscript 1, this thesis) focused first on the examination of the sport-specific face validity and the factor structure of a refined SRL-SRS survey in an adult North American individual-sport population. The refined SRL-SRS factor structure showed promising preliminary results for the application of this measure to a sport sample. Although some work may need to be done to improve certain facets such as the internal consistency of the reflection subscale, it showed a great improvement. Specifically, improvements were made on the face validity of the measure, along with the factor structure. The refinement of the SRL-SRS and assessment of the factor structure was completed in order to have confidence in an instrument to assess the associations between SRL processes (composite and constituent) and performance level in three escalating skill groups. Results indicated that a higher score in composite or overall SRL is associated with a greater chance of athletes belonging to the elite performance group. In

addition, our results suggested that composite SRL (i.e. a greater engagement in overall SRL processes) may represent an advantage attributable to elite athletes. Results for the six constituent SRL processes showed self-monitoring was the only process assessed with our refined SRL-SRS predicting the likelihood of membership in increasingly skilled performance groups. Interestingly, although self-monitoring appeared to be the most critical process in our analyses, our results also suggested that there may be other constituent SRL processes beyond self-monitoring that contribute to the elite group's benefit from overall SRL. Therefore, self-monitoring may be critical but also must be integrated within a larger cycle of self-regulated learning processes.

Using the same sample, Study 2 examined whether (1) overall engagement in SRL processes, and (2) greater engagement in each of the six constituent SRL processes, were associated with total amounts of DP (i.e., goal-oriented training aimed at improving technical and tactical aspects pertinent to one's sport) and physical preparation activities (PP; more general training, such as cross-training, devoid of technical and/or tactical aims) in various practice contexts. Our results showed that self-monitoring was the only predictor of total DP hours. It was also positively associated with DP in supervised and social practice settings. This suggests that self-monitoring may be an important aspect for greater engagement in overall DP hours. In fact, the benefit of self-monitoring may be especially pronounced for doing more practice in the presence of a coach or when training with other athletes. Additionally, planning was inversely associated with DP amounts only in supervised and social settings. Our final results for DP show effort being inversely associated with DP amounts in supervised settings.

When examining relationships between SRL and PP, we found associations for both self-monitoring and effort that contrasted the associations each of these processes had with DP. Whereas self-monitoring was positively associated with DP, it was inversely associated with

total PP and PP in all four practice settings. This may suggest that regardless of the training context, self-monitoring is not essential for maximizing amounts in physical preparatory activities (e.g., cross-training, weight training, mobility work). Whereas effort (i.e., working hard and not giving up when practice tasks become difficult) was inversely associated with supervised DP, it was positively associated with total PP and PP in all contexts. The contrast between DP and PP results is possibly attributable to differences in the nature of practice between these two variables; in keeping with literature (e.g., Hodges & Starkes, 1996), DP involves more cognitively effortful processes, and PP instead involves greater physical effort. There was also an inverse association between reflection and amounts of PP in unsupervised practice contexts. Finally, self-efficacy was positively related to PP in unsupervised and non-social settings.

The main purpose of Study 3 was to explore whether the influence of SRL on amounts of DP depends on individual differences in one's consideration of future (CFC-F) and immediate consequences (CFC-I). It had been suggested that CFC, as an individual difference variable, can differentiate people's ability to self-regulate in the development of sport expertise (Barone et al., 1997) where effective self-regulation would depend on one's ability to endure discomfort now for some gains later on. Therefore, we hypothesized that athletes higher in CFC-F may be able to connect the long term outcomes (e.g., being a high level athlete) and relate them to their current practice tasks in such a way to better self-regulate their learning toward their immediate DP, and may be more inclined to stay engaged at their current DP to reach future goals. We posited that athletes high on CFC-F would have stronger relationships between their SRL processes (both composite and constituent) and DP, compared to athletes low on CFC-F. We also posited that athletes lower on CFC-I would have a stronger relationship between their SRL processes (both composite and constituent) and DP, compared to athletes high on CFC-I. . However, results revealed no significant moderating relationships. Specifically, no significant moderating results

were found for both composite and constituent SRL processes relating to DP for both CFC-F and CFC-I. However, correlations between CFC-F and SRL indicated that athletes who consider the distal future consequences of their current behaviours engaged in higher amounts of SRL processes as they relate to their day-to-day training. Results also indicated that athletes higher on CFC-I, were less inclined to engage in overall SRL, evaluation, reflection and self-efficacy. Our results suggest that CFC is more likely be an antecedent to SRL rather than a moderator of the relationship between SRL and practice, therefore only impacting one's ability to self-regulate.

Methodological Considerations

The current research has many methodological considerations that can inform future research. The following section will discuss the methods and analytics such as the face validity and factor structure of the refined SRL-SRS, the validity and reliability in the binning of our participants, and the value of a composite SRL score. In Study 1, we have built on previous validation work relating to the SRL-SRS survey (Toering et al., 2012). More specifically, we took the step of pursuing rigorous work to vet the face validity of the original SRL-SRS (Toering et al., 2012) items in a sport training context. This work indicated that many of Toering et al.'s original items could be improved by adding "during practice" to make them context-specific. Reviewers' comments voiced concerns that certain items are not relatable to athletes, especially with wording around "solving problems" and "calculations", and recommendations were made for rephrasing these items. Based on the collated comments from our nine independent reviewers of the items, we elected to insert an instructional preface informing respondents about the nature of practice and practice tasks, and to undertake minor modifications to items. Specifically, were added phrases (e.g., "during practice", "after practice") so items suited sport training (35 items were modified with this phrasing) and we rephrased wording around "solving problems" and "calculations" in terms of "difficulties" or "challenges" and "practice tasks" (9 items were

modified accordingly). Using AMOS and SPSS to refine the factor structure and evaluate the CFA indices, the final refined measurement model indicated a good model fit and significant improvement compared to the fit of the original items for our sample of athletes. Thus, a strength of our resultant measurement model representing the 31 refined SRL-SRS items is improved factorial validity (Bartulovic & Young, 2016). Importantly, the resultant scales remain congruent with the six scales identified as being conceptually important by Toering et al. (2012): planning, self-monitoring, evaluation, reflection, effort and self-efficacy. The final survey is a suitable measure of SRL that is specific to the sport training domain, which can be used with athletes.

In Study 1, our analyses to differentiate our skill groups helped to extend prior research. For example, compared to Toering and colleagues' (2009) study as a basis, the current logistic regression analyses used more discriminant skill groupings by having three progressively valid skill groups (i.e., recreationally competitive, less-elite, elite). Consequently, we were able to more easily make interpretations and inferences regarding developmental perspectives by differentiating a highly-skilled and intermediately-skilled group from the least-skilled group, and by further differentiating the highly-skilled group from the intermediate group. In a review by Tedesqui, Bartulovic and Young (2016) on the 17 studies relating to DP in sport (as identified in Baker & Young, 2014), all studies that adopted the expert-novice paradigm reported significant group differences. However, only five studies compared three or more skill groups and, of these five studies, only two studies showed complete correspondence in post-hoc differences between all of their groups.

With regards to Study 1, a unique methodological approach was developed to validly and reliably bin participants into statistically discriminant groups. This is an important methodological issue, given recent work discussing the need for valid indices to capture skills groups (Baker, Wattie, & Schorer, 2015). We were able to use statistics to ensure discriminant

validity in how we binned our three progressively skilled groups. This has not been done in any previous research and should be considered in future studies using different level skill groupings (Tedesqui et al., 2016).

One of the methodological strengths in the current approach was our effort to ensure that we had reliable self-report data. Not only did we prompt participants to use external sources of recall such as training logs, online archived results or other sources, we also asked participants to disclose what specific form of recall they used, if any. The fact that we could state that 70% of our participants used some sort of external source of recall is important because it gives us more confidence in the data. Future research should consider consistently reporting the sources of reliable recall.

Another methodological strength of the current research was the use of a composite SRL score. The composite SRL score was obtained by averaging the score of each of the constituent SRL processes since they each process carries the same weight. Only one previous study has created a composite SRL score (Kitsantas & Zimmerman, 2002), however no associations to skill group differences were previously made. The comparison of beta weights between the composite SRL score and the simultaneous constituent SRL processes helped us tease out the interactions between self-monitoring and other SRL processes. Specifically, the beta weight for composite SRL was greater than the beta weight for self-monitoring, allowing us to infer that engagement in several other SRL processes was likely part of the expert advantage. Future research may also consider using a composite SRL score to gain more information about the interaction of SRL processes.

Conceptual Considerations

The results presented in the current research have a bearing on theoretical premises. We will discuss the role of self-monitoring, and other SRL processes in relation to Zimmerman's

(2006) social cognitive model and the DP framework. In this thesis, we were able to assess the two hallmarks of expertise (Ericsson et al., 1993; Ericsson & Smith, 1991) – 1) establishing expert-novice differences in a phenomenon of interest (e.g., SRL), and 2) examining relationships between a phenomenon of interest and DP in sport. These two hallmarks were tested in Study 1 and Study 2 respectively. Overall, our results partially supported the two hallmarks. The combination of results from our first two studies has highlighted the role of self-monitoring in SRL, particularly its association with skill group status, and with DP. It seems to be a key process for expertise, whether it may be to attain greater performance levels or to engage in more DP. Although this is a plausible explanation, we cannot discount alternative interpretations such as that perhaps more elite athlete are predisposed to self-monitor more. There also may be other intermediary mechanisms that allow athletes to maximize DP.

Our results also have some conceptual implications for work on Zimmerman's social cognitive model of self-regulated learning (Zimmerman, 2000), and studies that have used this model (Toering et al., 2009; 2012). The present findings suggest that self-monitoring may be at the center of the SRL model where cognitive online processes during training may be critical for the engagement of other SRL processes. It seems as SRL and perhaps more specifically self-monitoring is an important component of Zimmerman's social cognitive model. Other processes such as planning, effort, and self-efficacy were also found to be distinguishing factors for skill group differences. Results from our study suggest that when these SRL processes are engaged along with self-monitoring, this may contribute to an elite advantage. We acknowledge that effort and self-efficacy are part of the model as motivational aspects; however, it would be interesting to look at these processes as outcomes.

Results from Study 2 have implications for how researchers might characterize differences between DP and other more-general or less cognitively-engaging forms of training.

Our results suggest that the presence of a coach or other individuals diminishes the need or expectation for planning on the part of the athletes. We also found that athletes who report high levels of engagement in hard physical work may also report engaging in less amounts of DP in the presence of a coach. Therefore, the demands of physical effort may not be characteristic of DP in supervised settings, but may be more characteristic of cognitive effort (e.g. concentration). This finding is corroborated by the findings that self-monitoring – online cognitive processes – are pronounced in supervised settings. Previous research has also advocated for mental effort during DP activities (e.g., Hodges & Starkes, 1996). If future research can corroborate our findings, self-monitoring may be used as a way to determine what constitutes DP. Rating methods that ask participants to judge activities on characteristics of DP such as concentration, effort, relevance and enjoyment (e.g., Young & Salmela, 2002) could incorporate the requirement of high levels of self-monitoring as another characteristic criterion. In other methods such as the one presented in this thesis (Hopwood, 2013), one may consider adding self-monitoring in the definition of activities that comprise DP.

The current investigation of CFC served as the first instance where CFC was examined as a moderator in a sport sample. Thus, our current study addresses a major gap in the literature and our results may pave the way for future research regarding the CFC variable in sport. For instance, in Study 3, CFC was found to be an antecedent to SRL where CFC may predispose individuals to self-regulate more, rather than a moderator as previously hypothesized. Future research on CFC might better consider CFC as an antecedent.

Limitations and Future Research

Given the exploratory nature of some of the research in the current thesis, a few limitations warrant discussion. Our study had a mixed gender sample and most analyses controlled for gender, however, future research should consider investigating gender interactions.

In addition, all three performance groups were collapsed in Studies 2 and 3. It is possible that since only elite athletes hold an SRL advantage (Manuscript 1, this thesis), it may only be significant for this specific athletic group. Future research should investigate skill group interactions as well. This may also be the case for the moderating effect of CFC on SRL-DP relationships – whereby it may only be evident for the elite group. Furthermore, survey-based data were used for all three studies. With such methods, we are not able to draw conclusions on the quality of DP or SRL processes. Therefore, we can only discuss results in terms of maximization and not necessarily optimization of practice. It might be interesting going forward to replicate these studies with in-situ measures. For example, measures of DP could be set up experimentally (e.g., Coughlan et al., 2014). Participants of varying skill levels can be afforded opportunities to self-select how they practice and rate the characteristics of deliberate practice (e.g., effort and enjoyment).

This thesis examined how SRL was associated with three escalating skill groups (Study 1), and separately examined the association between SRL and DP (Study 2). However, the relationship between DP and skill group levels was never examined. It is possible that DP could mediate the relationship between SRL and skill/performance level and future research should examine this hypothesis. Finally, a cross-sectional design was used for this thesis. This design is limited in that we were unable to measure the direct relationships that SRL has with skill groups and DP through a temporal continuum. As such, future research may wish to identify the impact that SRL has on the development in skill acquisition and the engagement of DP going forward, rather than using retrospective surveys for weekly DP at one point in time. We recognize that our sample was an individual sport sample; therefore some results may vary and may not be generalizable across all sports, particularly team sports. For example, self-monitoring may not be as prevalent, or on the other hand, it may be more important in team sports. Future research

should examine the role of SRL in team sport to confirm or contrast our results.

Although our refined survey inventory is an improvement over the original scale, there remain some issues to be resolved. Future work should try to remedy some remaining issues such as giving more breadth to the reflection subscale, and improving internal consistency of the reflection subscale. Additionally, further CFAs should also be performed for replication on additional sport samples. Given the results from Study 2, adding a new subscale to the refined SRL-SRS to assess a cognitive aspect of effort such as a concentration subscale would be useful in order to tease out the differences in cognitive versus physical effort.

Another methodological advance in this thesis was the initial examination of the factor structure of the CFC-14 instrument (Joireman et al., 2012) in a sport sample. We used AMOS to verify the CFA indices of the CFC variable in a North American individual sport sample. By finding good CFA indices for the CFC-14 scale with no need for modification from the intended model, with evidence of two separate subscales for CFC-F and CFC-I, we therefore can note that that CFC -14 scale measure is suited for a sport population. Due to the fact that we did not fully confirm its factorial validity with a second, independent hold-back sample, future research should consider examining the same CFC-14 measurement model with new athletic samples.

Practical Implications

The summation of work presented in this thesis has a few important practical implications for athletes, coaches, training directors and training curriculum designers. Specifically, results could inform how these individuals go about making decisions regarding training practices. Finding from Studies 1 and 2 provide tangible and evidence-based recommendations that might inform which particular skills one might want to focus in in order to achieve higher levels of performance or in order to engage in greater amounts of DP. It seems as if self-monitoring may be a key component of SRL that athletes and their coaches should direct their attention to.

Indeed, our findings in Study 1 suggest that, without frequently engaging in self-monitoring, engagement in further SRL processes becomes difficult. In addition, from Study 1, we notice that elite athletes have a greater overall engagement in SRL processes, therefore it is imperative to use the information acquired from self-monitoring and apply it to other SRL processes such as for evaluating and reflecting on practice tasks. Self-monitoring could be emphasized in a coaching environment, and more specifically (based on results from Study 2) in the presence of a coach or when training with others. Coaches should be aware of their role for facilitating athletes' SRL strategies from a co-regulatory point of view – whereby the coach supports, influences, or prompts the athlete's regulation processes. From a curriculum perspective, self-monitoring may be taught and encouraged to athletes, or given self-coaching handbooks, where athletes would be able to learn independently. In Study 3, we found that CFC may predispose certain individuals to self-regulate more frequently. If future research were to replicate this finding and also relate it to an expert advantage, CFC could potentially be used as a screening variable to find individuals who are more likely to engage in such SRL processes and possibly attain higher levels of performance. Coaches and athletes may take these findings to apply them to their own coaching on how best to manage their time in respect with facilitating one's practice efforts.

In conclusion, the total body of work from this thesis has demonstrated many theoretical, methodological and practical advances and novel findings relating to SRL in sport expertise and in relation to DP. It was also one of the first studies to empirically incorporate and examine CFC in a sport setting. Furthermore, these findings have contributed to bridging the gap in the literature concerning certain SRL processes and their role in DP.

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Statement of Contributions

My contributions as the primary investigator were the conceptualization of the research, recruitment of participants, the data analyses, and the writing of the manuscript and the following chapters. Dr. Bradley W. Young, as my thesis supervisor, helped me challenge, clarify and refine my ideas for this thesis. He provided feedback and edits for my survey measures, data analyses, the manuscript, and chapters in the current document. He was also instrumental in the piloting of the SRL-SRS by inviting professors to vet the SRL-SRS. In addition, he assisted in the modification of the measure based on the feedback received from professors. My labmates, Justin MacLellan, Meagan Littlejohn, Rafael Tedesqui and Scott Rathwell also provided input on the modifications made to the SRL-SRS.

Appendices

Appendix A: Letter of Information to Organizational Representatives



uOttawa

Université d'Ottawa
Faculté des sciences
de la santé
École des sciences de
l'activité physique

University of Ottawa
Faculty of Health
Sciences
School of Human
Kinetics

Dear organizational representative,

I am contacting you in the hope that you will consider endorsing a research project and grant us permission to gain the consent of athletes who attend your sport club.

This study is a research project within the School of Human Kinetics at the University of Ottawa conducted by Ms. Bartulovic in the context of a Master's thesis, under the supervision of Professor Young. The purpose of this research is to assess how individual differences in self-regulation relate to the amounts of deliberate practice in which athletes engage in, as well as the performance level athletes attain. For the current project, only competitive athletes 18 years of age and older will be included. Using an online survey, we will measure weekly training amounts, performance level, athletes' self-regulated learning strategies, and how they view their current sport behaviours in relation to future achievement outcomes.

Participants will be asked to complete a survey only once. The survey is available in English only, therefore, it is important that all participants are able to read, and understand English. The survey will take approximately 30 minutes to complete.

In accordance with ethical procedures at the University of Ottawa, all information that participants provide will remain confidential and steps will be taken to ensure the anonymity of participants during all stages of the study. Although this study is occurring at multiple clubs/events simultaneously, data will not be presented or discussed in relation to any one specific club/event. In all cases, data will be analyzed and reported at the group level to protect the anonymity of individual participants. All collected information will remain safe and secure at all times. All original data will be electronic and will be safely stored using the certified-secure online survey provider "Fluid Survey" in a password protected account. Only the investigators listed below will have access to the data collected.

Participation in the study is entirely voluntary. If at any time a participant wishes to withdraw from the study, he or she may do so freely without penalty of any kind. Participants will be given the option to enter their email

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in a draw to win one of six cash prizes valued at \$50 each, even if they choose to withdraw from the study at any point. Although very unlikely, there is a remote possibility of athletes feeling some discomfort when asked questions about their current behaviours in relation to future achievement outcomes. In such circumstances, participants may contact the researchers below to request information for appropriate resources to help with such discomfort.

This study has the potential to identify psychological strategies that relate to improved quality and increased quantity of athletic practice. This knowledge may allow sport coaches to adapt training strategies to help athletes maximize their practice time, performance and their overall experience in sport.

In light of this, we would like to ask your permission to recruit participants. We would ask you to consider forwarding an e-mail about the study along with a safe and secure weblink to an informed consent page. We would ask you to forward the email via Bcc (blind carbon copy) to protect the privacy of potential participants. Once you forward this e-mail to potential participants, they will be able to access an embedded link, which will direct them to a website URL that contains an information letter followed by a consent form where they can indicate whether they wish to participate. Only after reading information about the study on this first page, and being informed that participation is voluntary and that they have the right to withdraw without penalty at any time, athletes can start the survey.

Should you feel that this study would be of interest to athletes affiliated with your club, we would ask that you indicate your consent by sending back the completed form below.

If you would like more information, please contact the investigators below to discuss any questions that you may have regarding this research project.

Dora Bartulovic
M.A. Candidate
School of Human Kinetics
University of Ottawa
125 University Avenue, MNT 416B,
Ottawa, ON, K1N 6N5
Email: [removed]
Phone: (xxx) xxx-xxxx

Bradley W. Young, PhD
Associate Professor
School of Human Kinetics
University of Ottawa
125 University Avenue, MNT 333, Ottawa,
ON, K1N 6N5
E-mail: byoung@uottawa.ca
Phone: (613)562-5800 x. 4252

To whom it may concern,

My name is _____, and I am the club representative of the _____ (name of club/event). I have been contacted by Dora Bartulovic, a M.A. Candidate at the University of Ottawa working with Dr. Bradley W. Young on research relating to athletes' athletic development. I endorse this research and Dora has my permission to recruit athletes attending our club. I understand that athletes will need to give informed consent before they can freely participate in this study. I understand that all research procedures conform to ethical procedures at the University of Ottawa and that participation in the study is voluntary and at any time it is possible for participants to withdraw freely from the study without penalty of any kind. Below, I am checking off all boxes to which I consent:

.. I will forward to potential participants an e-mail containing an online link to information about the study and a letter of informed consent. When I forward the e-mail, I will do so via Bcc (blind carbon copy) to protect the privacy of potential participants.

Signature: _____

Date: _____

Appendix B: Consent Form for Athletes

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Faculté des sciences
de la santé

École des sciences de
l'activité physique

University of Ottawa
Faculty of Health
Sciences

School of Human
Kinetics

Title of Project: Relationships between Deliberate Practice, Self-Regulation and Consideration of Future Consequences in Expert and Less-Expert Competitive Athletes.

Principal Investigator: Dora Bartulovic, M.A. Candidate, School of Human Kinetics, University of Ottawa, (xxx) xxx-xxxx, e-mail: [removed]

Co-Investigator: Bradley W. Young, PhD, associate professor, School of Human Kinetics, University of Ottawa, (613) 562-5800 ext. 4252, e-mail: byoung@uottawa.ca.

Purpose of the Study: This study is a project conducted by Ms. Bartulovic in the context of a Master's thesis, under the supervision of Professor Young at the University of Ottawa. The purpose of this research is to assess how individual differences in self-regulation relate to the amounts of deliberate practice in which athletes engage in, as well as the performance level athletes attain.

Participation: Once you read this consent form, in which you will be informed of the purpose and requirements of the study, you will be asked to complete the survey only once. The survey is written in English, therefore, it is important that all participants are able to read, write, and understand English. The survey will take approximately 30 minutes to complete.

Benefits: Your participation in this project will help contribute to scientific knowledge. In addition, this study has the potential to identify athletes' psychological strategies that relate to improved quality and increased quantity of sport training. This knowledge may allow sport coaches to adapt training strategies to help athletes maximize their training time, performance and their overall experience in sport.

Confidentiality and Anonymity: Your anonymity will be protected. The information collected will not be associated with the club where you are registered. This consent form will be stored electronically on a password protected computer in project supervisor's locked office. Physical copies of information will be kept under lock in the supervisor's office as well. All identifiable information in the consent form will be filed separately from survey data, to protect your anonymity. All original data will be electronic and will be safely stored using the certified-secure online survey provider "Fluid Survey" in a password protected account. Only the investigators listed below will have access to the data collected.

To thank you for your contribution to the research project, you will be given the chance to win one of five cash prizes valued at \$50 each, even if you do not win.

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you choose to withdraw from the study at any point. Upon completion of the study, five emails will be randomly selected amongst those who have entered and the winners will be informed by email. To win the prize, the person must correctly answer a skill-testing question. If the person cannot be reached within 14 days from the date of the draw, the prize will be awarded to the next email that is randomly selected and so on until all five prizes have been awarded. The odds of winning a prize will depend on the number of study participants that choose to enter their email into the draw. The prize must be accepted as awarded or forfeited. Your email that you provide when you enter the draw is collected for the purposes of contacting you if you are selected in the draw. Your email and the contact information you have provided will be kept confidential and then destroyed once the prizes have been awarded. We reserve the right to cancel the draw or cancel the awarding of the prize if the integrity of the draw or the research or the confidentiality of participants is compromised. This draw is governed by the applicable laws of Canada. In accordance with the ethical procedures at the University of Ottawa, all the information you provide will remain confidential and all steps will be taken to ensure that only the researchers have access to your personal information.

Voluntary Participation and Withdrawal: Your participation is completely voluntary. Participants may withdraw from the project at any time without penalty. If, after you have submitted your survey data you wish to withdraw, you may contact the investigators and we will comply with your response by deleting your data. Also, your decision to participate or not will not in any way impact your access to the club or sport event where you are registered.

Risks: Although very unlikely, there is a remote possibility of athletes feeling some discomfort when asked questions reflecting on current behaviours in relation to future achievement outcomes. In such circumstances, you may contact the researchers below to request information for appropriate resources to help with such discomfort.

If you have any questions regarding this research project you can contact the principal investigator by phone at (xxx) xxx-xxxx or by e-mail at [removed]

For any questions regarding the ethical conduct of this project, you can contact the Protocol Officer for Ethics in Research, University of Ottawa, 550 Cumberland Street, Room 154, Ottawa, ON, K1N 6N5, (613) 562-5387 or ethics@uottawa.ca

Consent: I have read this consent form and I understand the procedures of this research project. Also, I understand that my participation is completely voluntary and that I may withdraw from the study at any time without penalty. By (1) clicking next on the web page below, or (2) by signing the hard copy of this form and providing your email where the survey link will be sent, I indicate my consent to participate.

I accept to participate in this project.

Please provide your e-mail (hard copy only):

If you are completing this consent form in person please complete two forms, keeping one for yourself and returning one to the investigator. If you are providing online consent, please print and keep a copy of this form for your records.

Name (Please Print)

Signature

Date

Appendix C: E-mail Script to Organizational Representatives

Dear club/event representative,

Thank you for returning your letter of organizational consent. This follow up email is intended to invite athletes attending your club/event to participate in a research study from the University of Ottawa conducted by the principal investigator, M.A. Candidate Dora Bartulovic and the project supervisor Dr. Bradley Young.

If you please, ask your athletes to follow the link below to find more information about this study. We really appreciate if this e-mail could be forwarded to athletes who fit the inclusion criteria for participation in the study (i.e., competitive athletes aged 18+).

[Link to informed online consent form – Appendix B]

Please note that by forwarding this e-mail to potential participants, you are providing further authorization for this research study to be conducted with athletes attending your club/event.

On behalf of the research team, thank you for your kind attention,

Dora Bartulovic
M.A. Candidate
School of Human Kinetics
University of Ottawa
125 University Avenue, MNT 416B,
Ottawa, ON, K1N 6N5
Email: [removed]
Phone: (xxx) xxx-xxxx

Appendix D: Recruitment Letter

Dear athlete,

The University of Ottawa is currently seeking athletes (aged 18+) from individual sports to complete an anonymous and brief online survey (20-30 minutes).

We have learned from previous research that people vary in the extent to which they consider the distant consequences of their current actions. For example, those who consider the long-term implications of their behaviours tend to take better care of their health, exercise more, and have a better GPA compared to individuals who consider more immediate outcomes.

Because athletic improvement is often a long-term result of several years of dedicated practice, we have good reasons to believe that the tendency to consider long-term consequences has a strong influence on athletes' ability to remain engaged in practice and develop their athletic skills.

To find out if our reasoning is sound, we need your valuable collaboration with our study. With your help, this research will allow us to understand what helps athletes manage their motivation and training demands on the long road towards the most elite levels of their sport. Then, we will be able to inform coaches about how to best help athletes persist through challenges in their athletic development.

If you are an athlete who fits the criteria above, please access the secure link below:

[Link]

Providing consent only takes a few minutes. Athletes, parents, and coaches will be given the opportunity to request a summary of the findings of the study. If you would like more information, please feel free to contact the investigators below. Thank you once again and we wish you continued success in your pursuits!

The Research Team.

Dora Bartulovic
M.A. Candidate
School of Human Kinetics
University of Ottawa
125 University Avenue,
MNT 416B, Ottawa, ON,
K1N 6N5
Email: [removed]
Phone: (xxx) xxx-xxxx

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École des sciences de
l'activité physique

University of Ottawa
Faculty of Health
Sciences

School of Human
Kinetics

Appendix E: Email Script to Athletes

Dear athlete,

Thank you for signing the consent form and providing your email to participate in our study.

Please follow our safe and secure link to find more information about this study. This link will bring you to an information letter and consent form, and after reading and understanding you may click next to access the survey.

[Link to online informed consent – Appendix B]

On behalf of the research team, thank you for your kind attention.

Dora Bartulovic

M.A. Candidate
School of Human Kinetics
University of Ottawa
125 University Avenue, MNT 416B, Ottawa, ON, K1N 6N5
Email: [removed]
Phone: (xxx) xxx-xxxx

Appendix F: Certificate of Ethics Approval

File Number: H06-15-20

Date (mm/dd/yyyy): 07/09/2015



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Bradley	Young	Health Sciences / Human Kinetics	Supervisor
Dora	Bartulovic	Health Sciences / Human Kinetics	Student Researcher

File Number: H06-15-20

Type of Project: Master's Thesis

Title: Relationships between Deliberate Practice, Self-regulation and Consideration of Future Consequences in Expert and Less-Expert Competitive Athletes

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
07/09/2015	07/08/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:

N/A

Appendix G: General Demographics

To thank you in advance for your participation in this study, we will be randomly drawing five emails to win a cash prize of \$50 each. To enter into the draw for one of these five \$50 cash prizes, please enter your e-mail address below:

*NOTE: This email address will only be used to contact you if you win one of the cash prizes.

E-mail Address:

Full Name:

Sex:

- Male Female
 You don't have an option that applies to me. I identify as (please specify)

Date of Birth:

Please use the following format: DD/MM/YYYY

What town/city do you currently live in?

What sport do you presently consider to be your MAIN SPORT (sport to which you dedicate most of your time)?

- | | | | |
|-------------------------------------|---------------------------------------|------------------------------------|------------------------------------|
| <input type="radio"/> Swimming | <input type="radio"/> Canoe (C1) | <input type="radio"/> Tennis | <input type="radio"/> Badminton |
| <input type="radio"/> Soccer | <input type="radio"/> Track and field | <input type="radio"/> Kayak (K1) | <input type="radio"/> Table Tennis |
| <input type="radio"/> Basketball | <input type="radio"/> Volleyball | <input type="radio"/> Nordic Ski | <input type="radio"/> Other |
| <input type="radio"/> Baseball | <input type="radio"/> Hockey | <input type="radio"/> Gymnastics | |
| <input type="radio"/> Alpine Skiing | | <input type="radio"/> Triathlon | |
| <input type="radio"/> Snowboarding | <input type="radio"/> Rugby | <input type="radio"/> Powerlifting | |

If other, please specify:

How many years have you been regularly training for and competing in your main sport?

Appendix H: Performance Level

The next series of questions will ask you to reflect on past experiences and performances in your main sport. Please use any information that might help you recall information about your sport history, such as personal training logs and online archived results. Take your time and answer as accurately as possible.

 NOTE: PLEASE ANSWER ALL REMAINING QUESTIONS AS THEY RELATE TO YOUR
 MAIN SPORT.

PLEASE USE ANY INFORMATION THAT MIGHT HELP WITH RECALL
 INFORMATION SUCH AS PERSONAL TRAINING LOGS, OR ONLINE ARCHIVED
 RESULTS.

Highest level of representation you have achieved in this sport as a JUNIOR (under 18 years of age) ?

- Local
- City
- Regional
- Provincial/State
- National (against others from across the country)
- International (against others from different countries)
- I did not compete as a Junior

Highest level of representation you have achieved in this sport as a SENIOR (18 years and older) ?

- Local
- City
- Regional
- Provincial/State
- National (against others from across the country)
- International (against others from different countries)

Current level of representation in this sport?

- Local
- City
- Regional
- Provincial/State
- National (against others from across the country)
- International (against others from different countries)

Please indicate information about your best performance ever below:

Your best performance mark. For example, minutes and seconds, distance in metres and centimetres, or number of points:

Event type. For example, 100 m sprint, long jump, 50 metre freestyle swim:

Name of competition (e.g. Canadian Cross Country Championships) and estimate of date achieved (month and year):

If possible please indicate a website (e.g. <https://www.swimmingresults.org>) where archived results can be verified:

Please indicate information about your best performance in the past 12 months below:

Your best performance mark. For example, minutes and seconds, distance in metres and centimetres, or number of points:

Event type. For example, 100 m sprint, long jump, 50 metre freestyle swim:

Name of competition (e.g. Canadian Cross Country Championships) and estimate of date achieved (month and year):

If possible please indicate a website (e.g. <https://www.swimmingresults.org>) where archived results can be verified:

Appendix I: Amounts of Weekly Practice Activity

During a typical in-season week of training (consider a typical training week that is 10 weeks prior to your major competition) how many hours per week do you spend in...

... Sport-specific practice?

Activities that directly resemble the technical and/or tactical demands associated with your main sport. These activities require physical effort as well as concentration and are aimed directly at improving performance. Please note that sport-specific practice does not include: Non-sport specific physical preparation activities such as strength and conditioning, weights, fitness, yoga, pilates or flexibility. Informal playful games relating to your main sport that you engage in for fun with friends and family such as pick-up basketball, street hockey, or swimming in the backyard pool. Please consider the number of HOURS PER WEEK in sport-specific practice for your main sport in the following four conditions:

A coach is present providing supervision to you and others.

A coach is present providing one-on-one supervision only to you.

No coach is present to provide supervision but you are practicing with others.

No coach is present to provide supervision but you are practicing on your own.

...Physical preparation?

Activities aimed at improving physiological and muscular capacities such as strength, power, endurance, and flexibility (e.g., strength and conditioning, weights, fitness, pilates, yoga, and flexibility training). For the following questions please refer only to your participation in physical preparation activities completed outside of sport specific practice, as separate stand-alone practice sessions. Please consider the number of HOURS PER WEEK in physical preparation activities in the following four conditions:

A coach is present providing supervision to you and others.

A coach is present providing one-on-one supervision only to you.

No coach is present to provide supervision but you are practicing with others.

No coach is present to provide supervision but you are practicing on your own.

..Mental preparation?

Activities aimed at improving your knowledge of your sport, your team, and/or your opponents. Examples of mental preparation activities include, but are not limited to, working with a psychologist, video analysis/review, watching your sport live or on television, reading about your

sport, surfing the internet for websites and articles about your sport, or talking about your sport with others. Please refer only to your participation in mental preparation activities completed outside of sport specific physical practice, as separate stand-alone preparatory activities.

HOURS PER WEEK:

Did you use any of the following external sources in recalling information (click off all those that apply) ?

- Training logs
- Online archived results
- Other _____
- I did not use any sources

Appendix J: The Refined Self-Regulation of Learning Self-Report Scale

Please read the following statements and choose the number that best describes the way you act when approaching challenges, difficulties, and/or tasks in your sport training.

Think about a challenge or difficulty you might face during practice. Think about when you have to overcome a difficult practice task. What do you do before you start? What do you do while you work out? What do you do after difficult practice tasks? And how often you act like this when approaching practice tasks? There are no right answers -- please describe yourself as you are, not how you want to be or think you ought to be.

Almost Never				Sometimes				Almost Always
1	2	3		4	5	6		7
1. I determine how to approach a practice task before I begin.	1	2	3	4	5	6	7	
2. I put forth my best effort when performing tasks at practice.	1	2	3	4	5	6	7	
3. I check aspects of my workout while doing it.	1	2	3	4	5	6	7	
4. I double-check to make sure I did practice tasks right.	1	2	3	4	5	6	7	
5. I develop a plan for resolving difficulties at practice.	1	2	3	4	5	6	7	
6. Even when I don't like a task during practice, I work hard to do well.	1	2	3	4	5	6	7	
7. I keep working hard even when sport training tasks become difficult.	1	2	3	4	5	6	7	
8. Before practice tasks, I carefully plan my course of action.	1	2	3	4	5	6	7	
9. I don't give up at practice even if a task is hard.	1	2	3	4	5	6	7	
10. While I am engaged in a practice task, I know how much of it I still have to complete.	1	2	3	4	5	6	7	
11. I am willing to do extra practice on tasks in order to acquire more skill.	1	2	3	4	5	6	7	
12. I try to understand the goal of a practice task before I do it.	1	2	3	4	5	6	7	
13. If I'm not really good at a task, I can compensate for this by practicing hard.	1	2	3	4	5	6	7	
14. I ask myself questions about what a practice task requires me to do before I do it.	1	2	3	4	5	6	7	
15. I work as hard as possible on all tasks at practice.	1	2	3	4	5	6	7	
16. I check my work all the way through a practice session.	1	2	3	4	5	6	7	
17. I check how well I am doing during practice tasks.	1	2	3	4	5	6	7	
18. I clearly plan my course of action before starting practice tasks.	1	2	3	4	5	6	7	
19. I look back and check if what I did in practice was right.	1	2	3	4	5	6	7	
20. Before practice tasks, I figure out my goals and what I need to do to accomplish them.	1	2	3	4	5	6	7	

- 21. I work hard at practice on a task even if it is not important. 1 2 3 4 5 6 7
- 22. I look back to see if I did the correct procedures at practice. 1 2 3 4 5 6 7
- 23. Before I do a practice task, I think through the steps in my mind. 1 2 3 4 5 6 7
- 24. After finishing, I look back on the practice task to evaluate my performance. 1 2 3 4 5 6 7

Please indicate your agreement with each of the following statements:

Strongly Disagree 1	Disagree 2	Slightly Disagree 3	Neither Agree Or Disagree 4	Slightly Agree 5	Agree 6	Strongly Agree 7
------------------------------------	-----------------------	------------------------------------	--	---------------------------------	--------------------	---------------------------------

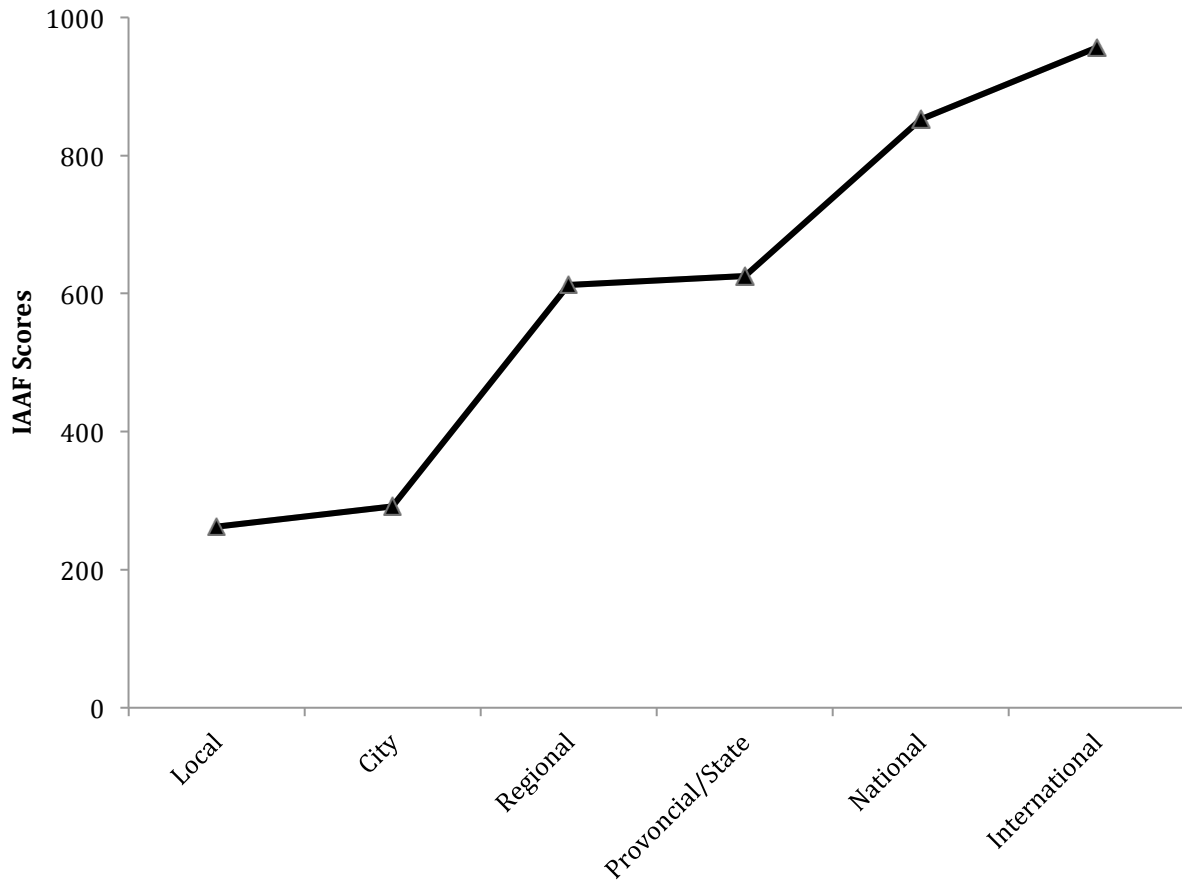
- 25. When I am confronted with a difficulty during practice, I can usually find several solutions. 1 2 3 4 5 6 7
- 26. When facing difficulties at practice, I can remain calm because I can rely on my coping abilities. 1 2 3 4 5 6 7
- 27. I often think about my past experiences at practice to gain new insights. 1 2 3 4 5 6 7
- 28. No matter what comes my way at practice, I am usually able to handle it. 1 2 3 4 5 6 7
- 29. I am confident that I can deal efficiently with unexpected events at practice. 1 2 3 4 5 6 7
- 30. When thinking about my training, I often reflect about my strengths and weaknesses. 1 2 3 4 5 6 7
- 31. I know how to handle unforeseen situations during practice, because I am resourceful. 1 2 3 4 5 6 7

Appendix K: The Consideration of Future Consequences Scale

For each of the statements below, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) please fill-in a "1" on the answer sheet; if the statement is extremely characteristic of you (very much like you) please fill-in a "7" on the answer sheet. And, of course, use the numbers in the middle if you fall between the extremes. Please keep the following scale in mind as you rate each of the statements below.

1. _____ I consider how things might be in the future, and try to influence those things with my day to day behaviour.
2. _____ Often I engage in a particular behaviour in order to achieve outcomes that may not result for many years.
3. _____ I only act to satisfy immediate concerns, figuring the future will take care of itself.
4. _____ My behaviour is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions.
5. _____ My convenience is a big factor in the decisions I make or the actions I take.
6. _____ I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.
7. _____ I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.
8. _____ I think it is more important to perform a behaviour with important distant consequences than a behaviour with less important immediate consequences.
9. _____ I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.
10. _____ I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.
11. _____ I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.
12. _____ Since my day-to-day work has specific outcomes, it is more important to me than behaviour that has distant outcomes.
13. _____ When I make a decision, I think about how it might affect me in the future.
14. _____ My behaviour is generally influenced by future consequences.

Appendix L: Means Plot of IAAF Scores Relative to the Six Performance Levels



Appendix M: Correlation Matrix between SRL Subscales Before and After EFA

Table M1

Correlations between subscales before EFA

	Planning	Self-monitoring	Evaluation	Reflection	Effort	Self-efficacy
Planning	1.00					
Self-monitoring	.782	1.00				
Evaluation	.816	.949	1.00			
Reflection	.779	.847	.810	1.00		
Effort	.448	.669	.590	.617	1.00	
Self-efficacy	.434	.577	.465	.634	.747	1.00

Table M2

Correlations between subscales after EFA

	Planning	Self-monitoring	Evaluation	Reflection	Effort	Self-efficacy
Planning	1.00					
Self-monitoring	.582	1.00				
Evaluation	.765	.687	1.00			
Reflection	.590	.452	.557	1.00		
Effort	.385	.537	.482	.508	1.00	
Self-efficacy	.357	.410	.282	.501	.642	1.00

Appendix N: Result Tables of Regressions for All Analyses of SRL Predicting Skill Group Membership

Table N1

Summary of Multinomial Logistic Regression Analysis for Contribution of Composite SRL toward Prediction of Performance Groups with Recreationally Competitive Group as the Reference Group

Performance Group		B	SE	Wald	Sig.	Exp (B)	95% Confidence Interval for Exp (B)	
							Lower Bound	Upper Bound
Less-elite	Age	-.375	.060	38.598	.000	.688	.611	.774
	Composite SRL	.582	.343	2.876	.090	1.790	.913	3.510
	Male	.271	.516	.276	.599	1.312	.477	3.608
Elite	Female	0	.	.	.	.	.	.
	Age	-.295	.053	31.479	.000	.744	.671	.825
	Composite SRL	1.148	.334	11.790	.001	3.153	1.637	6.073
	Male	-.553	.466	1.409	.235	.575	.231	1.434
	Female	0	.	.	.	.	.	.

Note. Gender and Age were entered simultaneously as independent control variables.

Table N2

Summary of Binomial Logistic Regression Analysis for Contribution of Composite SRL toward the Prediction of the Elite compared to Less Elite Group

	B	S.E.	Wald	df	Sig.	Exp (B)
Gender	-.878	.336	6.848	1	.009	.416
Composite SRL	.597	.219	7.404	1	.007	1.817

Note. Gender was entered simultaneously as an independent control variable. Male was coded as the lower value.

Table N3

Summary of Multinomial Logistic Regression Analysis for The Simultaneous Contribution of the Constituent SRL Processes toward the Prediction of Performance Groups, with Recreationally Competitive Group as the Reference Group

Performance Group		B	SE	Wald	Sig.	Exp (B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Less-elite	Age	-.383	.064	36.272	.000	.682	.602	.772
	Planning	.156	.287	.297	.586	1.169	.666	2.052
	Self-mon	.811	.317	6.529	.011	2.251	1.208	4.193
	Evaluation	-.085	.282	.092	.762	.918	.528	1.597
	Reflection	-.467	.297	2.470	.116	.627	.350	1.122
	Effort	.139	.318	.190	.663	1.149	.615	2.144
	Self-efficacy	.159	.269	.352	.553	1.173	.693	1.985
	Male	.035	.533	.004	.948	1.035	.364	2.946
	Female	0 ^b	.	.	.	.	.	.
Elite	Age	-.317	.058	29.996	.000	.728	.650	.816
	Planning	.305	.278	1.208	.272	1.357	.787	2.338
	Self-mon	1.011	.310	10.616	.001	2.748	1.496	5.049
	Evaluation	-.100	.274	.133	.715	.905	.529	1.547
	Reflection	-.596	.292	4.168	.041	.551	.311	.976
	Effort	.303	.315	.928	.335	1.354	.731	2.511
	Self-efficacy	.496	.263	3.552	.059	1.641	.980	2.748
	Male	-.861	.493	3.058	.080	.423	.161	1.110
	Female	0 ^b	.	.	.	.	.	.

Note. Gender and Age were entered simultaneously as independent control variables.

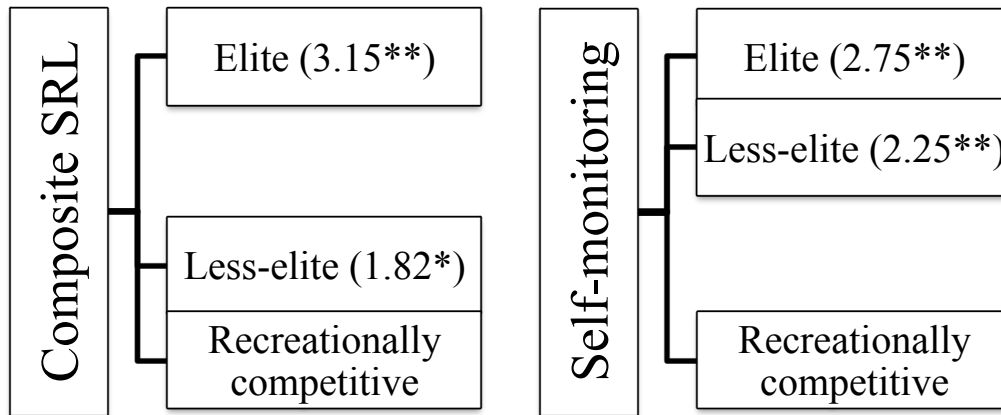
Table N4

Summary of Binomial Logistic Regression Analysis for Variables Predicting Performance Groups by the 6 Constituent SRL Processes Between Less-elite and Elite, Controlling for Gender

	B	S.E.	Wald	df	Sig.	Exp (B)
Gender (Male)	-.978	.349	7.861	1	.005	.376
Planning	.204	.203	1.012	1	.314	1.227
Self-monitoring	.277	.220	1.589	1	.207	1.319
Evaluation	-.061	.193	.100	1	.751	.941
Reflection	-.148	.170	.758	1	.384	.862
Effort	.128	.223	.328	1	.567	1.136
Self-efficacy	.348	.196	3.164	1	.075	1.416
Constant	-3.156	1.475	4.578	1	.032	.043

Note. Gender was entered simultaneously as an independent control variable. Male was coded as the lower value.

**Appendix O: Overview Summary Figure of Significant Findings from Logistic Regressions
for Composite and Constituent SRL Processes**



Note: Two asterisks represent results from multinomial logistic regressions with the recreationally competitive group as the reference, while one asterisk represent results from the binomial logistic regressions comparing elite versus less-elite group.

Appendix P: Last Blocks of the Hierarchical Regression Models Examining CFC-F and CFC-I as Moderators of the Relationship between SRL and DP

Table P1

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Composite SRL and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	P	R ²	Δ R ²	B	p
Model summary	.08	.00		.000	.09	.00		.000
Age			-.06	.000			-.06	.000
Gender			.22	.099			.21	.112
Composite SRL			.03	.817			-.19	.180
CFC			-.01	.939			.09	.446
SRL*CFC			-.28	.185			.18	.326

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P2

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Planning and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model Summary	.122	.007		.000	.118	.002		.000
Age			.068	.000			-.067	.000
Gender			.221	.103			.219	.108
Planning			-.044	.673			-.108	.280
Self-monitoring			-.203	.207			.213	.015
Evaluation			.000	.990			-.000	.997
Reflection			.033	.633			-.025	.721
Effort			.144	.112			-.148	.107
Self-efficacy			.082	.297			-.080	.313
CFC			.004	.972			.055	.647
Planning *CFC			.174	.148			.107	.357

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P3

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F And CFC-I as a Moderator of the Relationship between Self-Monitoring and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model Summary	.118	.003		.000	.121	.006		.000
Age			.06	.000			.06	.000
Gender			.23	.086			.20	.143
Planning			.05	.512			-.04	.593
Self-monitoring			-.29	.016			-.12	.257
Evaluation			.00	.927			.00	.917
Reflection			.03	.671			.03	.598
Effort			.13	.130			.16	.082
Self-efficacy			.09	.254			.08	.303
CFC			.00	.953			.05	.648
Self-monitoring*CFC			.14	.317			-.26	.177

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P4

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Evaluation and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model summary	.119	.004		.000	.118	.003		.000
Age			.68	.000			.06	.000
Gender			.22	.099			.22	.099
Planning			.05	.510			.05	.505
Self-monitoring			-.20	.020			-.20	.020
Evaluation			-.07	.472			.04	.615
Reflection			.03	.666			.03	.669
Effort			.14	.113			.14	.105
Self-efficacy			.08	.283			.07	.348
CFC			.00	.975			.05	.638
Evaluation *CFC			.12	.284			-.11	.351

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P5

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Reflection and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model summary	.115	.001		.000	.116	.000		.000
Age			.06	.000			.06	.102
Gender			.22	.101			.22	.000
Planning			.05	.510			.05	.517
Self-monitoring			-.20	.019			-.20	.021
Evaluation			.00	.953			.00	.953
Reflection			-.00	.951			.04	.611
Effort			.14	.115			.14	.122
Self-efficacy			.08	.283			.07	.320
CFC			.00	.941			.05	.644
Reflection *CFC			.06	.594			-.04	.690

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P6

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Effort and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model summary	.116	.001		.000	.117	.002		.000
Age			.06	.000			.06	.000
Gender			.23	.083			.21	.120
Planning			.05	.514			.05	.512
Self-monitoring			-.21	.016			-.19	.024
Evaluation			.00	.943			.00	.976
Reflection			.02	.701			.02	.702
Effort			.08	.472			.21	.098
Self-efficacy			.08	.267			.07	.321
CFC			.00	.955			.05	.658
Effort *CFC			.111	.477			-.130	.405

Note. The *p* value of the model summary refers to the *p* of the full model.

Table P7

Results for the Last Block of the Hierarchical Regression Model Examining CFC-F and CFC-I as a Moderator of the Relationship between Self-Efficacy and Sport-Specific Practice

	CFC-F				CFC-I			
	R ²	Δ R ²	B	p	R ²	Δ R ²	B	p
Model summary	.116	.001		.000	.117	.001		.000
Age			.06	.000			.06	.000
Gender			.23	.089			.22	.104
Planning			.05	.519			.05	.501
Self-monitoring			-.20	.019			-.20	.020
Evaluation			.00	.951			.00	.989
Reflection			.02	.706			.02	.749
Effort			.14	.107			.14	.119
Self-efficacy			.02	.801			.13	.221
CFC			.00	.957			.05	.660
Self-efficacy *CFC			.09	.501			-.10	.469

Note. The *p* value of the model summary refers to the *p* of the full model.