An Analysis of the Relationship between Self-Efficacy and Performance in a Continuous Gymnastic Routine

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Abstract

Research has shown a consistent correlation between efficacy and sport performance (Moritz, et al., 2000). This relationship has been shown to be dynamic and reciprocal over seasons (e.g., Myers, Payment, et al., 2004), within games (e.g., Butt, et al., 2003), and across trials (e.g., Feltz, 1982). The purpose of the present study was to examine self-efficacy and performance simultaneously within one continuous routine. Forty-seven undergraduate students performed a gymnastic sequence while using an efficacy measure. Results indicated that the efficacy-performance relationship was not reciprocal; previous performance was a significant predictor of subsequent performance ($p < .01$; βs ranged from .44 to .67). Results further revealed significant differences in efficacy beliefs between groups with high and low levels of performance [F (1, 571) = 7.16, $p < .01$]. Findings suggest that high levels of performance within a continuous physical activity task result in higher performance scores and higher efficacy beliefs.

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Chapter One: Introduction

1.1 Introduction

Successful performances in sport and physical activities are the goals of many athletes. Coaches and athletes are constantly in search of ways to enhance sport and physical activity performance. In order to do so, researchers must investigate what factors affect athletic performance behaviours in order to improve them. Not only is physical training important to performance, but also the psychological training aspect. For example, psychological factors such as cognition, motivation, and emotion have all been shown to affect athletic performance. Social cognitive theory attempts to explain how these psychological factors affect human behaviour and how human behaviours in turn affect these psychological factors. This study attempts to study specific psychological effects on physical activity performance behaviours that occur during one continuous educational gymnastic sequence.

1.2 Social Cognitive Theory

Social cognitive theory is a way of understanding human cognition, action, motivation, and emotion. This theory assumes that people are capable of planning, self-reflection and self-regulation; people are active shapers of their environments as opposed to passive reactors (Maddux, 1995). The individual's environment is considered to be a network of causal structures that are influenced by a person's behaviours, situational conditions, and personal features. These factors interact in a reciprocal process that motivates and affects behaviour (Bandura, 2001).

There are four basic principles of social cognitive theory which are the centrality of cognitive construals, social embeddedness of self and personality, self-regulation, and reciprocal causation. Centrality of cognitive understanding assumes that people have a

powerful capability to symbolize. People attempt to understand their world by organizing, categorizing, and labelling aspects of their environment, including features of themselves and others. The ability to symbolize allows others' behaviour to be represented in memory, permits observational learning that reduces trial-and-error learning, and increases successful training of complex skills (Bandura, 1986; Maddux, 1999). Observers learn how to exercise skills under specific conditions and observe the possible consequences (Maddux, 1999). Along with the ability to symbolize others' behaviours, people are also assumed to have the capacities for self-awareness and self-reflection. These abilities allow for the analysis of a person's own thoughts and feelings (Maddux, 1995). As behaviours are assumed to be goal-directed and guided by forethought and prediction, people are capable of developing mental images of possible future events to be achieved or avoided (e.g., goals) and strategies to do so (e.g., plans) (Bandura, 1997). The most important of these strategies are the expectations of the effects of one's behaviours under certain conditions (Maddux, 1995).

The second principle of the social cognitive theory is social embeddedness of self and personality. An individual's behaviour is largely influenced by the anticipation of other people's thoughts, feelings, and actions (Maddux, 1999). This is known as social learning. Social cognitions are the explanations and predictions about other people's behaviours, feelings, and thoughts. The combination of social cognitions and environmental or situational factors result in social learning that influences behaviour (Bandura, 1977). Understanding an individual cannot be achieved without understanding social cognitions including social goals, expectations, situational norms, and the cognitive construction and organization of the self and others (Maddux, 1999).

The third principle of the social cognitive theory is self-regulation. People are dynamic shapers of their environments, behaviours, thoughts, and emotions. People actively control their behaviour by selecting or altering their environments. Behavioural control is also achieved by evaluation of actions against adopted personal standards. This creates personal incentives that motivate and guide behaviour (Bandura, 1986; Maddux, 1995). Self-regulation consists of several interactive elements including goal-setting, planning, implementing plans, monitoring feedback, evaluating behaviours, reacting to feedback of self-evaluation, and correcting actions. The self-regulation process is not linear but rather reciprocal (Maddux, 1999).

The fourth principle of the social cognitive theory, and perhaps the most important, is reciprocal causation (Maddux, 1999). Reciprocal causation assumes that environment, inner personal factors (cognitive, emotional, and biological events), and behaviour are mutually interacting factors (Bandura, 1997; Maddux, 1995). People respond to situations through behavioural control which influences the situational environment as well as cognitive, affective and biological states. This is known as the principle of "triadic causation" or "triadic reciprocality" (Maddux, 1999). Bandura (1989) referred to this framework as a model of "emergent interactive activity". These personal, environmental and behavioural influences are reciprocal and not necessarily simultaneous or of equal strength. A complete understanding of human behaviour requires an understanding of these sources of influence.

1.3 Self-Efficacy Theory

Self-efficacy theory is part of the more general framework of the social cognitive theory. It is primarily concerned with the reciprocal effects of cognition on emotion and

behaviour and of behaviour, affect, and environment on cognition (Maddux, 1995). Self-efficacy is described as the beliefs in one's abilities to organize and execute the courses of actions required to produce specified attainment (Bandura, 1997). In other words, self-efficacy beliefs are not judgments about what skills you possess but rather evaluations of what can be achieved with those skills. Self-efficacy is specific to certain domains of functioning rather than a mass of general beliefs without context (Bandura, 1997). Feltz (1988) suggested that self-efficacy can be considered situational-specific self-confidence. There has been a recommendation by Feltz, Short, and Sullivan (2008) that confidence and efficacy can be used synonymously. Based on this suggestion, the terms will be used interchangeably throughout the present study.

Self-efficacy is multidimensional and dynamic. Beliefs can vary along several dimensions including strength, level, and generality (Bandura, 1997). Strength is the certainty of the person's beliefs that he/she can succeed at different levels of performance ranging from complete certainty to complete uncertainty (Feltz, Short, et al., 2008). Strong self-efficacy beliefs allow for greater persistence in the face of difficulties and a higher possibility that the activity will be performed successfully (Maddux, 1995).

Level of self-efficacy refers to the range of a person's perceived ability that is measured against the difficulty of a specified task. These are the number of "steps" in increasing difficulty that a person believes he/she is capable of successfully performing (Maddux, 1995). If the activity is easy and there are no difficulties to overcome, then perceived confidence should be consistently high. Adding difficulties that could hinder performance will increase the ability of a person to predict specific efficacy beliefs.

Situational contexts contain the conditions in which performance efficacy is judged (Bandura, 1997).

Lastly, generality refers to the number of tasks, activities, and domains of functioning that people judge themselves to be efficacious (Feltz, Short, et al., 2008). Individuals may be efficacious in a number of different activities or only a few. Generality can depend on a number of factors including similarity of activities, ways that abilities are expressed (behavioural, cognitive, and affective), features of situations, and personal characteristics. Assessments linked to domains and situations show the patterns and the degree of generality of efficacy beliefs (Bandura, 1997).

Self-efficacy is defined within a specific context (Maddux, 1995), and can be specific to a task at a particular level of performance (Yeo & Neal, 2006). However, the level of specificity that confidence is measured is determined by the nature of the task and the situation (Bandura, 1992). It is possible that even within this domain of performance one may lack efficacy for one aspect of functioning (i.e., task or subskill) but not another. For example, it is possible that a female gymnast is highly efficacious for back flips performed on the floor apparatus, but inefficacious for back flips executed on the beam. Task experience may provide information to individuals on how to judge their confidence for a specific task. This evaluative information may be a crucial source as to how individuals develop self-efficacy (Bandura, 1997).

1.4 Developing Self-Efficacy

In order to develop self-efficacy, Bandura (1997) considered four principle sources. Enactive mastery experiences are considered to be past performance accomplishments (Feltz, Short, et al., 2008). Vicarious experiences include observing

other people's actions, abilities, and behavioural consequences, and using this information to form potential views about personal behaviours (Maddux, 1995). Verbal persuasion strengthens beliefs through the influence and motivation of significant others. Physiological and affective states allow people to judge their abilities, strengths, and weaknesses through somatic information (Bandura, 1997).

Any influence on efficacy beliefs may operate through one or more of these sources. The cognitive processing of efficacy sources involves two functions. The first function involves the type of information attended to and used as an indication of personal efficacy. Each of the four sources has a distinctive set of indicators that provide self-appraisal information. The second function is to incorporate and weight information from different sources when constructing efficacy beliefs (Bandura, 1997).

1.4.1 Enactive mastery experiences. The most influential source of self-efficacy beliefs are enactive mastery experiences as they serve as an indication of ability (Bandura, 1997). In general, repeated successful accomplishments increase confidence whereas repeated negative experiences (failures), lower confidence (Maddux, 1995). A durable and stable sense of self-efficacy requires experiencing successes despite obstacles. Experiencing difficulties provides opportunities to learn from failures and to turn failures into successes. Once successful, people become more confident that they have the abilities required for the skill. This results in increased persistence when experiencing additional difficulties and quicker rebounds from personal setbacks (Bandura, 1997).

Changes in self-efficacy do not necessarily result from the performance of a skill. Although in general successes raise efficacy beliefs and failures lower them, this is not

always the case. The cognitive processing of ability information during a performance may affect confidence. The same level of performance may increase, decrease or have no affect self-efficacy depending on how various personal and situational factors are interpreted and given significance (Bandura, 1997). Knowing how these various factors affect the cognitive processing of ability information provides an understanding of how people's efficacy beliefs are enhanced or diminished as a result of mastery experiences.

There are several personal and situational factors that affect the cognitive processing of ability including pre-existing self-knowledge structures, task difficulties, contextual factors, effort expenditure, selective self-monitoring and reconstruction experiences, and goal attainment trajectories (Bandura, 1997). Pre-existing self-knowledge structures involve a representation or "schema" with large information networks. These schemata influence how people perceive, interpret and organize efficacy information. People retrieve their previous experiences through memory when making their efficacy judgements. Biases in efficacy beliefs result from pre-existing self-schemata. Inconsistent experiences with previous self-efficacy beliefs tend to be diminished or reconstructed in memory. In contrast, experiences that are congruent with self-efficacy beliefs are considered important and are remembered (Bandura, 1997).

When assessing performance information, task difficulty and contextual factors provide self-appraisal value of ability when judging successes and failures. Success at an easy task is superfluous when compared with previous accomplishments and does need efficacy reappraisals. Mastering more difficult tasks result in new efficacy information which can raise beliefs in personal capabilities (Bandura, 1997). Task difficulty may not be understood only by the features of the task but also by the perceived similarity to other

activities. The use of normative information about the success rates of others who have performed the task may also be useful. Variations in the assessment of task difficulty will result in different appraisals of self-efficacy (Bandura, 1997).

Processing of ability in performance is in part determined by how much effort is spent while performing a task. Ability and effort are considered interdependent determinants of performance. In order to judge ability, perceived normative difficulty and levels of effort are used (Bandura, 1997). High ability is indicated when minimal effort is used to successfully complete a task that others may find difficult. In contrast, low ability is indicated when maximal effort is used to complete a task that others find easy and is therefore less likely to increase self-efficacy. Self-appraisals following a lack of success resulting from low effort render failures to be non-reflective of personal abilities. Conversely, failures on tasks where high or moderate difficulty is perceived are more indicative of abilities (Bandura, 1997).

Ability information may be influenced by selective self-monitoring and reconstructing of previous experiences. Attentional, physical, emotional, contextual and situational factors contribute to these biases. Early or intermediate phases of skill development are especially vulnerable to these biasing factors as skills have not yet been fully developed (Bandura, 1997). Selective attention or recollection of poorer performances is likely to result in underestimation of self-efficacy. Alternatively, efficacy beliefs can also be enhanced through focus on personal accomplishments (Maddux, 1995). These biases reside in both attentional and memory processes rather than judgements about the causes of personal successes and failures (Bandura, 1997).

Cognitive processing of ability information is affected by goal attainment courses. Goal achievement trajectories consist of periods of successes and failures. Rate of development and improvement varies with stage of skill acquisition (Maddux, 1995). Early improvements are generally faster and easier. Rapid gains are harder to come by in late phases of skill development as more intricate skills are demanded than at early or intermediate stages (Bandura, 1997). Thus, those who experience some intermittent failures but continuously improve over time are more likely to raise their self-efficacy beliefs compared to those who plateau during their development. These temporal, cumulative experiences are cognitive representations involving the memory for the situational context as well as the frequency of successes or failures in which they occurred (Bandura, 1997).

1.4.2 Vicarious experiences. Developing efficacy beliefs does not depend solely on previous performance experiences. Vicarious experiences (e.g., observational learning, modeling and imitation) alter efficacy beliefs through the comparison with the accomplishments of others. People use the information of others' actions and consequences to form expectancies for their behaviours (Maddux, 1995). Efficacy beliefs are heightened by supposed performance superiority in relation to group norms but lowered if outperformed compared to the normative rank (Bandura, 1997).

One specific aspect of vicarious experience is modeling. Modeling is described as observing others to form new ideas about behaviour and subsequently using these ideas as a guide for the new behaviours (Bandura, 1986). In terms of social comparison, models that are similar to a person are usually more likely to be used to judge personal abilities (Bandura, 1997; Maddux, 1995). If the similar model has the ability to

successfully complete an action, then the observer believes that he/she too has said ability, raising self-efficacy beliefs. Confidence can also be influenced if the observer has little experience with the activity. Models can provide information on how to successfully complete of the activity, which can boost confidence in people who have feelings of self-doubt. Even those with high self-efficacy can benefit from modeling (Bandura, 1997).

Vicarious experiences are generally weaker than direct experiences in their effect on efficacy beliefs (Maddux, 1995). However there are some circumstances when vicarious experiences can be more powerful than direct experiences. For example, when using comparative information from a similar model, should the model fail, people can be convinced that this is an indication of their own personal deficiencies. In contrast, modeling experiences that raise self-efficacy may weaken the impact of failure experiences and thus increase the persistence in effort even in the face of repeated failure (Bandura, 1997).

1.4.3 Verbal persuasion. Verbal or social persuasion serves as another method of developing and strengthening people's efficacy beliefs. It is suggested that it is easier to develop and maintain a sense of efficacy if significant others express faith and belief in one's capabilities (Bandura, 1997). Though verbal persuasion may be limited in its ability to ensure lasting effects on self-efficacy, it has the ability to encourage self-change if the evaluations are positive and realistic (Bandura, 1997). The potency of verbal persuasion can be influenced by factors such as the expertise, trustworthiness, and attractiveness of the source (Maddux, 1995). The experience of positive verbal persuasion is likely to encourage and prolong effort than if the verbal persuasion is in the

form of personal deficiencies. Persuasive encouragement engages people to try harder and promote the development of skills that may increase confidence. If unrealistic beliefs of abilities are expressed and the recipient experiences failure, it will discredit the persuader and undermine the beliefs of the recipient (Bandura, 1997).

Persuasive feedback is often given in the form of evaluative feedback. It can be conveyed in ways to both increase and undermine self-efficacy. For example, telling people that they have the ability, but gained it through hard work may lower self-efficacy as it suggests limited talents. Conversely, telling people that they have the ability without the reference to effort may increase confidence (Bandura, 1997). Another example of framing evaluative feedback involves focusing on achievements which highlight abilities. Evaluative information that focuses on shortfalls and the distance left the reach a goal highlights deficiencies and is likely to diminish confidence. Information that is framed in gains and improvement are likely to increase self-efficacy (Bandura, 1997).

1.4.4 Affective and physiological sources. The development of self-efficacy also involves physiological and affective sources. In order to judge abilities, people rely on somatic information from both physiological and emotional states. These indicators are especially pertinent in domains that involve physical accomplishments, health, and coping with stresses (Bandura, 1997). Unpleasant physiological activation can often be interpreted as vulnerability. In activities that involve strength and stamina, physiological indicators such was windedness, aches, and pains can be read as physical incompetence and poor behavioural performance (Maddux, 1995). The way to alter these beliefs is to enhance physical status, reduce stress levels and negative emotions, as well as correctly interpret bodily states (Bandura, 1997).

Emotion and mood can also affect judgements by influencing how events are interpreted. Emotions become associated with certain memories through networks of concepts. This assists the recollection of events linked with the emotion (Bandura, 1997). Negative moods can activate feelings of past failures and positive moods, feelings of past accomplishments. Efficacy judgements are enhanced or diminished by these memories (Maddux, 1995). For example, negative mood can activate a global view of inadequacy and worthlessness, which can diminish personal self-efficacy. Priming views place emphasis on affect or mood at the time of the inducing event in order to enhance the association between mood and recall of successes or failures (Bandura, 1997).

1.5 Effects of Self-Efficacy on Behaviour

Self-efficacy beliefs influence behavioural and thought processes including goal-setting and persistence, cognitive actions, affective processes, and selection of environments and activities (see Figure 1) (Maddux, 1995). Goal-setting behaviours include goal choices, goal trajectories, effort expenditure, and persistence. In general, people with stronger confidence beliefs increase their effort to accomplish their goals and persevere in the face of obstacles. These behaviours usually lead to the desired goals and thus increase self-efficacy. In contrast, people with weaker senses of self-efficacy may doubt about their abilities and give up more easily when faced with difficulties (Bandura, 1997; Maddux, 1995). When monitoring goal-setting behaviour, people develop beliefs about the rate of improvement towards their desired goal as well as their current level of confidence. In terms of rate of improvement, people are likely to attempt new behaviours should they expect to rapidly gain improvement. If improvement is expected to be slow and arduous, new behaviours are less likely to be attempted (Maddux, 1995).

Self-efficacy influences cognition in four ways. Strong self-efficacy beliefs influence people to set higher goals. The strength of the self-efficacy beliefs influences the plans and strategies to reach these goals. Self-efficacy affects the development of rules for predicting future events. These beliefs also impact problem solving behaviours. People with high confidence for problem solving are more efficient and effective decision makers. Those who doubt their problem-solving abilities can become inefficient, ineffective and erratic when faced with complex tasks (Maddux, 1995). By influencing goal-setting behaviours, attainment strategies, conventions for predicting possible outcomes and problem solving behaviours, self-efficacy is observed to influence cognition.

Self-efficacy beliefs influence affective responses in two ways. The first way is by the intensity and type of affective responses. For example, low self-efficacy beliefs for the prevention of harmful events may lead to anxiety or agitation. Self-efficacy can influence emotional responses and subsequently influence coping efforts and physiological processes (Maddux, 1995). The second way that self-efficacy influences affective responses is by controlling for cognitions that influence emotional reactions. For example, people may become distressed about their inability to control disturbing thoughts or notions of failure. These ideas can also lead to lower confidence beliefs (Maddux, 1995).

Lastly, self-efficacy influences the selection of environments. People tend to enter situations where they expect success. The possible achievement in these conditions enhances self-efficacy beliefs (Maddux, 1995). Choosing events where people believe they have the necessary skill to be successful validates the situational decision. However,

people avoid situations and activities in which they do not expect to succeed. They deprive themselves of situations where there is the potential of successful experiences which could counter a low sense of self-efficacy (Maddux, 1995).

1.6 The Relationship between Self-Efficacy and Sport/Physical Activity Performance

The relationship between self-efficacy and sport performance has been demonstrated in numerous studies with early series of research lead by both Feltz (e.g., Feltz, 1982; Feltz, Landers, & Raeder, 1979; Feltz & Mugno, 1983) and Weinberg (e.g., Weinberg, Gould, & Jackson, 1979; Weinberg, Gould, Yukelson, & Jackson, 1981; Weinberg, Yukelson, & Jackson, 1980). Their research led to a line of inquiry that extends to the present. Differences among studies include participants (e.g., professional athletes, athletes with disabilities, university students), designs (experimental vs. non-experimental), and self-efficacy measures. Statistical variants used include the use of path analyses (e.g., Feltz, 1982; Feltz, Chow & Hepler, 2008), regressions (e.g., Feltz & Lirgg, 1998; Lee, 1982), self-efficacy as an independent variable (e.g., Weinberg et al., 1979; Weinberg et al., 1980), and self-efficacy as a dependent variable (e.g., Lirgg & Feltz, 1991; Weinberg, 1985). Even physical activity situations that are not considered competitive sport have demonstrated the efficacy-performance relationship (e.g., Lerner & Locke, 1995). Despite the variability in research methods, tasks, and measures, results have shown abundant support for the positive relationship between self-efficacy and sport/physical activity performance (Feltz, Short, et al., 2008).

The Feltz line of research used high avoidance tasks, which are activities that require operationalized skills and include an aspect of risk to complete (e.g., back dive).

If the situation is considered too unpleasant, the participant will experience a withdrawal reaction (Feltz, Short, et al., 2008). Feltz et al.'s (1979) study investigated the effect of different sources of self-efficacy information (i.e., videotape modeling, live modeling, and participant modeling) on efficacy beliefs as well as learning and performing the high avoidance task of the modified back dive. Self-efficacy was assessed prior to the intervention, after the training period, and after the testing period. Although the findings showed that the participants in the participant-modeling condition showed better back dive performance and higher confidence ratings than participants in other conditions, the design did not allow for the study of whether self-efficacy beliefs mediated any treatment effects on performance (Feltz, Short, et al., 2008).

The Weinberg studies were the first to use to competitive situations to examine the relationship between physical activity performance and self-efficacy. In the first study, Weinberg et al. (1979) examined whether self-efficacy was related to performance in a muscular endurance task. The results showed an increase in persistence in motor performance when faced with obstacles when higher levels of self-efficacy were present. In an extension of this study, Weinberg et al. (1980) changed their methods by allowing back-to-back competition (e.g., simultaneous competition in which the participant and the confederate could not see each other) rather than direct competition (e.g., simultaneous face-to-face competition in which the participant and the confederate could see each other). Again, the results showed more persistence in the motor performance when self-efficacy levels were higher. They also found that the self-efficacy-performance relationship was stronger for males ($r = .31$) than for females ($r = .04$). However the correlations were not as strong as the previous study when direct competition was used.

Further studies have shown a consistent relationship between self-efficacy and performance in a variety of sport and physical activity situations. For example, the relationship between self-efficacy and gymnastic performance was studied for each of the four Olympic events for female athletes: vault, uneven bars, balance beam and floor. The correlations demonstrated consistent relationships that ranged from $r = .28$ (vault) to $r = .72$ (uneven bars) (McAuley & Gill, 1983). The gymnastic performance-efficacy relationship has also been shown with solely male subjects. Significant correlations were again demonstrated in all six Olympic events for male athletes, ranging from $r = .27$ (vault) to $r = .84$ (high bar) with an all-around score of $r = .71$ (Weiss, Wiese, & Klint, 1989). Both studies showed a significant relationship between efficacy and performance in the same sport despite differences in both subjects and methods. This relationship is not only robust within one sport but also among various sports and physical activity tasks, such as baseball, (e.g., George, 1994), basketball, (e.g., Chase, Ewing, Lirgg, & George, 1994), bowling (e.g., Boyce & Bingham, 1997), equestrian (e.g., Beauchamp & Whinton, 2005), marathon (e.g., Okwumabua, 1986), wrestling (e.g., Treasure, Monson, & Lox, 1996), and weight lifting (e.g., Lerner & Locke, 1995) to name a few.

Multiple meta-analyses have further emphasized the performance-efficacy relationship. Moritz, Feltz, Fahrbach, and Mack (2000) looked at the relationship between self-efficacy and sport performance in 45 studies, with the average correlation between self-efficacy and performance being .38 (95 % CI = .35-.41). These results suggested a moderate positive relationship between self-efficacy and performance. Moritz et al. (2000) suggested that task-specific self-efficacy measures (i.e., instruments that evaluate confidence for specified levels of performance for a particular task) resulted

in the highest correlations (r =. 38) compared to domain-specific and single-item measures. Concordant measures (i.e., analogous self-efficacy assessments and performance measures) also had a higher correlation (r = .43) to performance than non-concordant measures. A second meta-analysis by Woodman and Hardy (2003) showed that self-confidence was found to be significantly related to sport performance (r = .24). Self-confidence was found to be more strongly related to sport performance than cognitive anxiety (r = -.10). In a final example of meta-analyses by Craft, Magyar, Becker, and Feltz (2003), the researchers found that self-confidence showed the strongest and most consistent relationship with sport performance (d = .25, β = .36) when compared to cognitive anxiety and somatic anxiety.

Even within these meta-analyses, some studies failed to show correlations between sport performance and self-efficacy. Feltz, Short, et al. (2008) suggest that studies that did not show correlations could have been the result of using a non-traditional self-efficacy measure, using non-concordant measures, or having a time lag between self-efficacy and performance measures. Despite these inconsistent findings, the relationship between self-efficacy and performance is a robust and consistent result.

In addition to the positive relationship between performance and confidence, self-efficacy has also been shown to be a significant predictor of performance (Feltz, Short, et al., 2008). An example of this relationship is exemplified in an early study by Lee (1982), who studied efficacy and performance in trained athletes in competition as well as the comparison between predictive powers of self-efficacy with previous competitive performances. The sport chosen for this study was women's artistic gymnastics. The results showed that gymnasts could fairly accurately predict their competition

performances. These predictions were not affected by age or previous performance but rather by level of experience, level of ability and self-efficacy, with the best predictor being level of experience. Lee (1982) suggested that the "lesser accuracy" of the self-efficacy-performance relationship could be in part due to the small sample size and the delay in time between performance and confidence measures. Despite these limitations, this study continues to support the relationship between efficacy and performance and demonstrates the predictive effects of efficacy and sport or physical activity performance.

The relationship between efficacy and performance has been shown in individual sports such as triathlon (Burke & Jin, 1996), golf (Beauchamp, Bray, & Albinson, 2002), and rock-climbing (Llewellyn, Sanchez, Asghar, & Jones, 2008) but also team sports such as football (Myers, Feltz, & Short, 2004), and softball (Hepler & Chase, 2008). Though the studies looked at different sports and different types of sport and physical activities, the studies all suggest the existence of a positive performance-efficacy relationship, be it self-efficacy or collective-efficacy. Bandura (1997) stated that collective efficacy is a "group's shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainment" (p. 477) whereas self-efficacy pertains solely to individual's abilities. Whether the studies focus on group-confidence beliefs or self-confidence beliefs, the relationship between efficacy and performance reveals that higher efficacy scores predict the greater performance successes.

1.7 The Dynamic and Reciprocal Relationship between Self-Efficacy and Performance

Self-efficacy has been shown to be a variable construct as efficacy beliefs change when situations change. It has also been shown that the relationship between performance and self-efficacy is temporarily recursive and reciprocal (Feltz, Short, et al., 2008). In general, high self-efficacy beliefs lead to improved performance, which increases self-efficacy, and the pattern continues. As the pattern persists, efficacy beliefs dynamically change as new performance information is accrued (Bandura, 1997). Past performance is not only a source of efficacy beliefs (mastery experiences), but also a predictor of subsequent efficacy beliefs, resulting in modifiable efficacy beliefs (Feltz, Short, et al., 2008). For example, Heuze, Raimbault, and Fontayne (2006) studied a cohesion-collective efficacy-performance causal triangle in professional basketball teams. They suggested that collective efficacy was a consequence of prior performance as past individual performances contribute to perceptions of group confidence. The researchers further suggested that collective efficacy is a dynamic concept. As individual beliefs are adjusted based on new performance information, collective efficacy beliefs are also adjusted to account for individual performance successes or failures. These results ultimately suggested that the relationship between efficacy and performance is reciprocal and that efficacy beliefs are a dynamic and variable construct.

1.7.1 Changes in efficacy over the courses of sport seasons and games.

Efficacy has been shown to shift dynamically over distinct periods of time. In sport and physical activity research, efficacy beliefs have been shown to vary in strength over the course of a season. Using path analysis, George (1994) studied the effects of confidence,

competitive anxiety, and effort in the hitting performance of male intercollegiate baseball players over the course of season. Results demonstrated a dynamic change in self-efficacy as well as a reciprocal self-efficacy-performance relationship. As past performance significantly predicted self-efficacy, self-efficacy significantly predicted subsequent performance. The relationship between confidence and performance was not equal. George (1994) indicated that past performance showed a stronger and more consistent influence on self-efficacy than self-efficacy did on performance. Though the relationship between performance and efficacy was not equal, the results still revealed reciprocal relationship with efficacy beliefs continuing to dynamically shift within a defined temporal period.

In a study demonstrating confidence changes over an ice hockey season, Feltz and Lirgg (1998) examined both collective and self-efficacy patterns, their relationships to each other, and their relationship to performance. The hockey teams involved in the study completed the efficacy questionnaires no more than 24 hours before their weekend games. The findings showed that team efficacy beliefs were a predictor of team performance. It was also found that previous team performance influenced team efficacy beliefs more so than player beliefs. These results again suggested a reciprocal relationship between performance and efficacy beliefs, although previous team performance was not stated to be a predictor of team efficacy beliefs. Lastly, team efficacy beliefs significantly increased after a win and significantly decreased after a loss (Feltz & Lirgg, 1998) further demonstrating the variability of efficacy beliefs over a season.

MacLean and Sullivan (2003) further demonstrated the dynamic nature of efficacy beliefs in a study that followed one collegiate basketball team over a season. They measured collective efficacy and the performance measures of the rebound differential and field goal percentages per game. Their findings showed that collective efficacy fluctuated over a season in relation to the winning percentage of a team's upcoming opponent as opposed to performance of the team (MacLean & Sullivan, 2003). Though their hypotheses that team performance would be positively related to collective efficacy was not supported, collective efficacy was shown to change over the course of the season.

To examine the relationship between collective efficacy and team performance, Myers, Payment, and Feltz (2004) studied women's ice hockey teams over a season. The purpose of their study was to examine the effects of the Saturday collective efficacy on the Saturday performance after statistically controlling for the Friday (past) performance. A second purpose of the study was to examine the influence of the Friday performance on the Saturday collective efficacy after removing the effects of the Friday collective efficacy from the Friday performance. The results revealed that the average influence of the Saturday collective efficacy on the Saturday performance (after statistically controlling for the Friday performance) was a moderate, positive relationship. The average influence of the Friday performance on the Saturday collective efficacy (after statistically controlling for the Friday collective efficacy on the Friday performance) was a small, positive relationship. These findings suggested that collective efficacy and previous performance can influence team performance. Collective efficacy can enhance

team performance and previous performance can have a positive influence on subsequent collective efficacy even after negating for the influence of previous collective efficacy.

Further longitudinal studies on the reciprocal relationship between collective efficacy and team performance have been done over a competitive football season (Myers, Feltz, et al., 2004). Specifically, the researchers wished to study the relationship between collective efficacy (measured prior to performance) and subsequent team performance in an interdependent task. Results showed that collective efficacy positively influenced subsequent offensive performance, and previous offensive performance negatively influenced subsequent collective efficacy within teams and across games. The researchers speculated that previous performance negatively influenced collective efficacy due to the result of a temporal disparity between previous performance and subsequent efficacy measures as well as an inconsistency with task difficulty (differences in strengths of opponents). Results also revealed that combined collective efficacy scores were a positive predictor of subsequent offensive performance and previous offensive performance was a positive predictor of collective efficacy.

Though efficacy beliefs have been shown to fluctuate throughout the course of a season, it is also possible that efficacy can change over a shorter period of time. Butt, Weinberg and Horn (2003) studied the intensity and direction changes of anxiety and self-confidence and their relationship to performance throughout one game. The researchers used a repeated measure design during a field hockey tournament. The participants completed questionnaires at four different time points (pregame, during the first half of the game, during the second half of the game and postgame). The authors found that self-confidence was lowest at the pre-game measurement and increased in

intensity over the game to be significantly different from pre-game to post-game measurements. The findings also revealed that the strongest predictors of performance were the direction and intensity of self-confidence (Butt et al., 2003). These studies demonstrated that not only do efficacy beliefs dynamically fluctuate over the course of a season, but also over the course of a game. These variations may be due to new information resulting from the reciprocal relationship between efficacy beliefs and performance (Bandura, 1997).

1.7.2 Changes in efficacy from trial-to-trial. According to self-efficacy theory (Bandura, 1997), confidence beliefs should fluctuate as conditions change and information varies (i.e., task to task) throughout one performance. Though few studies have looked at this concept in sport and physical activity to date, research has been done in other areas. Yeo and Neal (2006) studied the relationship between task-specific self-efficacy and performance in an air traffic control task. The participants were asked to classify whether pairs of aircraft were in conflict or would pass safely as quickly and accurately as possible. Three task-specific self-efficacy questions were asked prior to each trial. Their findings revealed a significant cross-level interaction between task-specific self-efficacy and practice in that the positive relationship between performance and self-efficacy grew with practice. This interaction also revealed that individuals with different average levels of self-efficacy (low vs. high) showed differences in performance as those with higher self-efficacy showed greater performance scores. This difference in performance continued to increase with practice over trials. The authors suggest that this is because people who report high levels of self-efficacy learn faster than those with low reported self-efficacy, set higher goals and have a higher level of persistence. These

results demonstrate the dynamic nature of performance and self-efficacy in both people with low and high self-efficacy within one task.

Chiou and Wan (2007) studied the effects of prior self-efficacy and positive and negative task experiences on the current self-efficacy of participants over the course of an internet search task. In Study 1, the researchers divided a group of participants with medium prior confidence for internet shopping into one group that received three consecutive positive experiences and a second group that received three consecutive negative experiences. Each trial consisted of a search task for three items. The positive experience condition had a long amount of time to search for the items, and the negative experience condition had short period of time. During the study, self-efficacy was measured following each of the search trials (i.e., task to task). The findings revealed that the consecutive positive experiences led to a gradual increase in task-specific self-efficacy whereas consecutive negative experiences led to a rapid decrease.

A second study by Chiou and Wan (2007) compared two groups with distinct levels of self-efficacy; one group with high self-efficacy for internet shopping and one group with low self-efficacy for internet shopping. Similar to Study 1, each group was randomly subdivided to receive either consecutive positive or negative experiences during an internet search task. Immediately following each trial during the task, participants rated their confidence, resulting in an on-going measurement of self-efficacy during one task. The findings suggest that the enhancement effects of positive experiences were conditional on the individual's prior level of self-efficacy. That is, positive experiences appeared to be more effective for individuals with lower self-efficacy than for individuals with higher self-efficacy. Individuals with higher levels of

prior self-efficacy did not show significant augmentation effects following positive tasks. In contrast, the diminishing effects of negative task experiences were more significant for individuals with higher self-efficacy than for individuals with lower self-efficacy. The declining negative task experience effects were not apparent for participants with lower prior self-efficacy. Chiou and Wan's (2007) results from Studies 1 and 2 suggest that task-specific self-efficacy is cumulative and dynamic. Their findings further demonstrate the reciprocal process of previous self-efficacy, valence of task experience, and performance outcomes that result in a dynamic process in which self-efficacy changes from trial-to-trial.

Though no studies have looked at moment-to-moment changes in efficacy beliefs in sport and physical activity, there are studies that have examined the relationship between self-efficacy and performance from trial-to-trial. Watkins, Garcia, and Turek (1994) looked at the predictive relationship between self-efficacy and sport performance in a sample of youth baseball players. Hitting performance in batting cages over four trials was evaluated, with confidence measured prior to entering the batting cages immediately before each trial. Results in the fourth and final trial showed that hitting performance was predicted by both the previous trial's hitting performance and level of self-efficacy. Efficacy in the final trial was predicted by level of efficacy in Trial 3, hitting performance in Trial 3, level of efficacy in Trial 2, and hitting performance at baseline. The authors concluded that previous efficacy was related to hitting performance and that hitting performance predicted self-efficacy, again suggesting a reciprocal efficacy-performance relationship. It was also concluded that self-efficacy predicted subsequent efficacy. This suggested that previous self-efficacy and previous performance

can predict present self-efficacy which in turn can predict subsequent performance on a trial-to-trial basis.

The early Feltz studies showed both the reciprocal efficacy-performance relationship, as well as the dynamic trial-to-trial changes of self-efficacy in one physical activity task. Feltz (1982) used a path analysis to study a high avoidance task of attempting a modified back dive. The researcher used a self-report measure of self-efficacy, which consisted of a 100-point probability scale asking the subject the strength of her belief that she could successfully complete the back dive at each of the four board heights. The subjects completed the self-report measures prior to each of the four diving trials. The results showed a reciprocal relationship between self-efficacy and diving performance, though the relationship was not equally recursive. Once experience was gained in the task, performance had more of an effect on self-efficacy than self-efficacy had on performance. In other words, self-efficacy influenced performance less as the participants gained experience over trials and past performance became a stronger influence on subsequent performance than self-efficacy.

In a replication of Feltz's (1982) study, Feltz and Mugno (1983) looked at the effects of self-efficacy, past performance, autonomic perception and physiological arousal on the performance of a modified back dive. Again, Feltz and Mugno (1983) used a self-report measure of self-efficacy using the same question as Feltz (1982), but the scale ranged from 0-10 as opposed to 0-100. As in the previous study, self-efficacy was measured just prior to diving performance for each of the four trials. Using path analysis, Feltz and Mugno (1983) found self-efficacy was a major predictor of performance on Trial 1. Following Trial 1, previous back-dive performances were the

major predictors of subsequent performances over trials. Similar to Feltz (1982), this study showed the reciprocal relationship of self-efficacy and performance, though as before, they were not equally reciprocal. The strength of confidence as an effect on performance increased over trials, while its strength as a causal influence decreased. Although the findings showed that self-efficacy varied from trial-to-trial, confidence became less of a direct predictor of performance as subjects gained mastery experiences.

Some research (e.g., Feltz, 1982; Feltz & Mugno, 1983) has suggested that past performance is a stronger predictor of subsequent performance than efficacy beliefs. However there were problems with the invariance of the conditions in the studies. Feltz, Short, et al., (2008) suggested that when conditions are varied, efficacy beliefs are shown to be stronger predictors of future performance than past performance. Whether conditions are varied or unvaried, Bandura (1997) contended that performance cannot cause performance. He suggested that past performance is a complex, combined index that includes sociocognitive factors such as efficacy beliefs. Bandura (1997) suggested that these variables should be removed from past performance (i.e., residualizing past performance). In a re-analysis of the Feltz (1982) data, Feltz, Chow, et al. (2008) adopted the suggestion of Bandura (1997) of residualizing past performance. Feltz, Chow, et al. (2008) regressed the raw self-efficacy scores of the Feltz (1982) study and entered them into a model to remove any contributions of self-efficacy imbedded in past performance scores. Results showed that the amount of variance in performance accounted for by self-efficacy increased over trials from 54% to 75%. The researchers concluded that residual past performance was a weaker predictor of performance across trials and accounted for little variance during the later performance trials. Despite the

variability in statistical methods, the Feltz diving series further demonstrated the reciprocal process of the effects of previous self-efficacy on subsequent performance and past performance on subsequent self-efficacy. This relationship results in new efficacy information that dynamically changes self-efficacy from trial-to-trial throughout one specific physical activity task.

1.8 Conclusion

As suggested by social-cognitive theory, individuals are considered active regulators of their own environment and situational, inner personal factors (cognitive, emotional, and biological events) and behaviour are interacting factors (Maddux, 1995). Derived from social-cognitive theory is self-efficacy theory. Self-efficacy is the beliefs in one's abilities to perform required actions to produce a specified goal (Bandura, 1997). In general, sources of efficacy beliefs lead to the development of efficacy beliefs which in turn affect behaviours and thoughts (see Figure 1). Self-efficacy has been shown to be related to sport or physical activity performance (e.g., Feltz et al., 1979; Weinberg et al., 1979). These findings are robust and have been shown in many studies (Moritz et al., 2000). Further studies have shown that the relationship between self-efficacy and performance is reciprocal and temporally recursive (Feltz, Short, et al., 2008). As circumstances change, new information is revealed, and as a result, efficacy beliefs dynamically change (Bandura, 1997). The variation of efficacy beliefs and the reciprocal nature of the efficacy-performance relationship have been shown within specified periods of time in sport and physical activity including over seasons (e.g., Myers, Feltz, et al., 2004; Myers, Payment, et al., 2004), games (e.g., Butt et al., 2003), and trial-to-trial within one physical activity task (e.g., Feltz, 1982; Feltz, Chow, et al., 2008; Feltz & Mugno, 1983).

Chapter Two: Rationale, Research Questions, & Hypotheses

As previously noted in Chapter 1, self-efficacy and performance have repeatedly shown a positive and moderate correlation (Mortiz et al., 2000). This relationship has been demonstrated to be recursive, with self-efficacy beliefs dynamically changing based on new circumstantial information (Feltz, Short, et al., 2008). No studies have yet measured self-efficacy within one uninterrupted sport or physical activity task. It is important to assess self-efficacy within a sport and physical activity performances as efficacy is thought to change as performance information changes which may not only alter self-efficacy but also the efficacy-performance relationship (Bandura, 1997). The purpose of this study was to measure both self-efficacy and the efficacy-performance relationship within one uninterrupted physical activity performance.

2.1 Rationale

Despite the robust evidence for the existence of the variability of efficacy beliefs (Butt et al., 2003; MacLean & Sullivan, 2003) and the temporally recursive efficacy-performance relationship (e.g., Feltz, 1982; Feltz & Lirgg, 1998; Feltz & Mugno, 1983; George, 1994; Heuze et al., 2006; Myers, Feltz, et al., 2004; Myers, Payment, et al, 2004; Watkins et al., 1994), these concepts have not been studied concurrently with sport performance within one routine or competition. Feltz, Short, et al. (2008) suggest that investigating efficacy beliefs within one performance is a useful and enlightening to further knowledge of efficacy judgments interpreted simultaneously with "game action". Studying efficacy and performance simultaneously may also eliminate any influences that could bias self-efficacy beliefs when rated prior to or retrospectively following a physical activity performance.

Within one physical activity performance, new information is gathered and is used to re-evaluate self-efficacy which may result in a modification of efficacy beliefs (Bandura, 1997). As previously stated, the same level of performance may increase, decrease, or have no affect self-efficacy depending on how personal and situational factors are interpreted (Bandura, 1997). The current study intended to focus on whether performance influenced self-efficacy and whether self-efficacy beliefs influenced performance within one routine, as opposed to how personal and situational factors were interpreted. Due to the fact that there was a gap in the literature, and until a dynamic, reciprocal efficacy-performance relationship was shown within one performance, how situational and personal factors are interpreted could not be studied.

To develop a research study that examined self-efficacy during a performance presented a challenging endeavour. Asking participants to rate their confidence at the same time as performing a skill or task may have distracted from the accuracy of the performance or the efficacy rating. In order to understand changes in self-efficacy and the efficacy-performance relationship within one routine, it was necessary to develop a self-efficacy measure that could assess these beliefs and relationships without disrupting performance. It was important that the measures were task-specific and concordant in order to optimally measure self-efficacy beliefs (Mortiz et al., 2000). The scale used in this study was a single-item efficacy measure. Previous research has suggested that single-item measures do not demonstrate the highest correlation results and should not be used (Moritz et al., 2000). However, Feltz, Short, et al., (2008) suggest that a one-item verbal measure prompted at specific points in a single competition may provide an indication of changes in efficacy during a routine. These factors as well as Bandura's

(2006) recommendations for constructing an efficacy scale (i.e., domain specification, content relevance, item phrasing, response scales, challenge gradations, reduction of social evaluative concerns, and validity), were taken into account to create a measurement to investigate how self-efficacy and the efficacy-performance changed within one physical activity performance.

The physical activity task used to examine the research questions was educational gymnastics. Previous research on trial-to-trial measures of efficacy and performance has been done using one skill repeatedly without a large extent in the variability of skills (e.g., Feltz, 1982, 1988; Feltz & Mugno, 1983). As educational gymnastic routines vary in difficulty of skill, it added changeability in contextual factors that are evident in many sports or physical activity tasks. It also allowed for a fluctuation between both easy and difficult tasks in order to potentially demonstrate the modifiability of self-efficacy beliefs and the efficacy-performance relationship. As previously stated success at an easy task is redundant and does need efficacy belief reappraisals. Mastering more difficult tasks results in new efficacy information which can raise efficacy beliefs (Bandura, 1997). Furthermore, a sequence of many skills which lasted over a few minutes allowed ample opportunities to record self-efficacy beliefs during the course of one continuous performance.

The students in an introductory undergraduate educational gymnastics class were recruited as participants in the present study. Recruiting participants from a class at the university level allowed for a large number of participants to be trained to use the efficacy scale in a safe, controlled environment. It also helped the researchers track progress throughout the course of the semester regarding use of the scale during a

gymnastic sequence. The performance measure was based on the class evaluation as determined by the course instructor. Therefore, the participants knew what was expected and what constituted "good" performance, similar to "real" competition settings in which athletes are aware of what level of performance will result in favourable outcomes. The performance measure was specific to the task and the level of skill of all participants as it was specific to what was learned in the class, and not for use by artistic, rhythmic, or trampoline gymnasts.

2.2 Research objectives

The primary purposes of this study were to examine the relationship between self-efficacy and performance within one continuous performance and to measure the differences in self-efficacy beliefs over the course of one physical activity performance. The specific research objectives investigated included:

1. To assess whether previous performance predicted self-efficacy beliefs and measure whether self-efficacy beliefs predict subsequent achievements and errors and within one physical activity performance.
2. To investigate self-efficacy differences as a result of performance within the course of one physical activity task.

2.3 Hypotheses

The following hypotheses were forwarded as a result of the previously stated research objectives:

1. The relationship between performance and self-efficacy should be reciprocal with past performances predicting present self-efficacy beliefs after controlling for past self-efficacy beliefs, and past self-efficacy beliefs predicting present performance levels after controlling for past performance levels.

Rationale: Based on previous research, past self-efficacy should become a significant predictor of subsequent performance and past performance should become a significant predictor of self-efficacy beliefs (Feltz, 1982, 1988; Feltz, Chow, et al., 2008; Feltz & Mugno, 1983; George 1994).

2. Self-efficacy should show significant differences as a result of performance successes and failures (mastery experiences). Specifically, self-efficacy beliefs should be higher after successful performance experiences and be lower after failed performance experiences.

   Rationale: Based on self-efficacy theory (Bandura, 1997) and previous research on temporal changes in self-efficacy over seasons (e.g., MacLean & Sullivan, 2003), within games (Butt et al., 2003) and across trials (e.g., Feltz & Mugno, 1983), self-efficacy is a dynamic construct. As new performance information is accrued, differences in self-efficacy should result from this novel performance information (Bandura, 1997).

Chapter Three: Methodology

3.1 Participants

Forty-seven undergraduate students of a class of 75 were recruited from a foundational educational gymnastics course at a Canadian university at the start of the winter semester in January 2010. In previous studies, which included path analysis as a means of examining the efficacy-performance relationship, sample sizes ranged between 53 participants over nine trials (George, 1994) and 80 participants over four trials (Feltz, 1982, 1988; Feltz & Mugno, 1983). Klem (1997) suggests that in order to perform a proper path analysis, most models require 200 or 300 cases. The previously mentioned studies' models contained models of approximately 477 cases and 320 cases respectively, resulting in adequate sample size. The current study, containing 47 participants, examined five trials, resulting in a maximum number of cases of 235. Therefore, the sample size of the present sufficed for the selected statistical analysis.

At the time of recruitment, all students enrolled in the class were invited to join the study. In terms of sex differences in the self-efficacy-performance relationship, Weinberg et al. (1980) found that this relationship was stronger for men than women. However, Feltz (1988) found that the reciprocal relationship between confidence and performance was more consistent for females, and males did not initially show recursive efficacy-performance relationships. Feltz (1988) suggested that should there have been more trials within her study that the effect of sex may have been negated. Therefore, both male and female participants were included in the current study.

Additionally, no prior gymnastic experience was required to participate in the present study. Although most of the participants were considered novice athletes (as they

had no previous gymnastic training) some participants had prior gymnastic experience and were also included in the study. In educational gymnastics, athletes develop skills within their own ability and understanding. This is in contrast to competitive gymnastics in which athletes are to perform externally imposed movements patterns to achieve ideal skills and forms (Nilges, 1997). Educational gymnastics is taught in themes which embody four fundamental skills: rolling actions (weight transfer over adjacent body parts), step-like actions (weight transfer onto and off of nonadjacent body parts), flight (weight transfer involving loss of contact with a support surface), and balance (maintaining a body in stillness) (Nilges, 1997). Themes are created by joining one or more fundamental skills with concepts from a movement framework. It is through these themes that students enhance their movements and skill developments. Therefore, whether students have prior experience gymnastics experience or not, they all work within the themes and concepts of the course to develop their movement skills within their own abilities. This was also important in choosing a performance measure that could encompass all athletes, despite individual ability levels.

Furthermore, in terms of attentional factors when using athletes of varying levels of experience, Beilock, Carr, MacMahon, and Starkes (2002) found that the performances of expert athletes were interrupted when their attentional focus was on internal (i.e., skill) factors. However, the performances of novice athletes were interrupted when their attentional focus was on external (i.e., environmental) factors. According to Feltz, Short, et al. (2008), Beilock and Feltz (2006) suggested that processing information from various sources may detract from novice performances. This may be due to the process of forming efficacy beliefs, which may require attention and "use up" attentional capacity

that should be used for successful execution of skills (Feltz, Short, et al., 2008). Though this may be the case, both novice and experienced participants were trained to use the efficacy scale from the beginning of their physical activity experience in an introductory class. Therefore, they were trained to execute the required skills and to successfully allocate attentional resources to rate their self-efficacy simultaneously.

Of the 47 participants in the study, 27 were male and 20 were female. All participants were enrolled as full-time or part-time undergraduate students at a Canadian university. The mean age of the participants was 20.32 (SD = 1.49) with participants ranging in age from 19 to 25. Fifteen participants had some previous experience in gymnastics, 27 had no previous experience, and five failed to indicate any previous gymnastic experience. Of the 15 participants who had previous gymnastics experience 12 were female and 3 were male. Their mean previous experience was 5.38 years (SD = 4.39) with previous training ranging from 1 to 13 years. Levels of previous gymnastic training as indicated by the participants included artistic recreational gymnastics (9 participants), artistic competitive gymnastics: regional level (2 participants), artistic competitive gymnastics: provincial level (1 participant), rhythmic recreational gymnastics (2 participants), and competitive acrodance (1 participant).

3.2 Procedures

Prior to the beginning of the present study, institutional ethics clearance was received (see Appendix A). Permission from the course instructor was obtained to recruit participants from a fundamental educational gymnastics course at a Canadian university. The course occurred in the winter semester of the school year, over 13 weeks, from January to April. It consisted of one, 1-hour lecture per week and one, 2-hour movement

lab session per week. The lab session was divided into three sections; each student was enrolled in one section. The class self-divided into these sections based on the students' own scheduling preferences and the availability of lab times.

Participant recruitment occurred in the second week of classes, at the start of the weekly lecture. Students were provided with a brief PowerPoint presentation as outlined in Appendix B. At the end of the presentation, students were invited to ask questions. Any student who wished to participate in the study was asked to sign the consent form (see Appendix C), and fill out the demographic questionnaire (see Appendix D). The principal student investigator re-collected all consent forms and demographic questionnaires, which were placed in training folders (see Section 3.3.3).

In order to train the participants to use the scale during performance, the principal student investigator attended every lab session over the course of the semester. The purpose of training to use the scale was to ensure that participants obtained the ability use the efficacy measure during their performance, without impairing their ability to respond to the scale or perform the sequence. It was assumed that when the participants performed their final sequence, the use of the efficacy scale was automated. This assumption was tested through a series of questions posed to the participants each week (see Section 3.3.3). Training to use the scale (see Section 3.2.1) was implemented in the movement labs immediately following the recruitment in lecture and ran eight weeks, with the final presentations presented in the ninth week of training.

During the latter half of the lab sessions in week 7 and the entire lab sessions in week 8 of training, the students created the final performance sequence in pairs. Partners chose two themes based on the knowledge they accumulated over the semester: one

relationship theme (matching, mirroring, copying, or negotiations) and one balance awareness theme (twisting and turning, balance, and symmetry and asymmetry) or spatial awareness theme (directions and pathways). This sequence was performed in week 9 of training. The final pair sequence was performed twice: first using the efficacy measure for the principal student investigator, and second without using the efficacy measure for the course instructor. The performance using the efficacy measure was conducted first as to protect against any previous performance effects. For example, should the participant have performed poorly for the final class evaluation, it may affect initial confidence scores.

The final sequences were videotaped by a Sony HDR-XR500V High Definition Handycam Camcorder. Each participant was provided with individual microphones (Sony ECM-HW2 Wireless Microphone). Participants practiced with the microphones and the cameras in weeks 7 and 8, but were not recorded until week 9 during the final performances. Before the final performances, the principal student investigator reminded each participant of the efficacy scale, the performance measure, and the use the scale. The participants were also reminded of the prompt "scale" should they forget to use the scale. At this point, the participants were asked if they had any questions. The participants were given the microphone and a "microphone check" was done to ensure the principal student investigator could hear the participants. Once the microphone was working, the participants began the performance. For the final performance, the performances were not started until the principal student investigator informed the participants that the camera was recording. Once the final performances were completed, the participants were asked to rest before their final performance sequence with the

instructor and thanked for their participation. As the participants performed in three separate labs, a debriefing email was not sent to the participants until all of the participants had completed the study. The email (see Appendix E) was sent to the course instructor and forwarded to all students.

Upon completion of the final performances, video recorded data was converted to DVD by the Sony software one-touch burn technology as provided with the Sony cameras on a Gateway M-6878 laptop computer. DVDs were given to two independent scorers who rated performance based on performance measurement criteria (see Section 3.3.1). Scorers were asked to watch the videos with the sound off as not bias performance evaluations with efficacy scores. Scorers were given a copy of the performance measure and a list of skills performed in the participants' routines to record their performance evaluations. Each skill was awarded a numerical value using the scoring criteria as outlined in the performance measure. The scorers and the principal student investigator set a time limit that the performance evaluations were to be completed within two weeks. Once the evaluations were completed, they were returned to the principal student investigator.

3.2.1 Training. Training of the efficacy scale followed the lab content as determined by the course instructor. In each lab, there were three components: warm-up, movement development, and partner sequence work. During the movement development component of the lab, the course instructor taught the students to use the skills based on the theme for the week (see Appendix F). Once the students had learned and practiced the skills of the weekly theme, they separated into partners. When paired, the students constructed sequences containing the week's theme in the remaining lab time. It is

during this time that the principal student investigator asked the participants to practice using the efficacy scale during performance.

At the beginning of every lab, the principal student investigator handed out the training logs and provided verbal instructions to the participants for practicing the efficacy scale (see Appendix F). Throughout the lab, the principal student investigator visited each participant to see his/her progress and answer any questions. The participants were reminded each week of the scale, the performance measure, and how to use the scale as well as to respond as quickly and as accurately as possible. At the end of each lab session, the participants completed the training log (see Section 3.3.3). The participants then returned the training logs to the principal student investigator who kept the logs in a secured location. This procedure was repeated during the first six weeks of training, with training in weeks 7 through 8 being focused solely on the final sequence. Week 9 of the course was the lab in which the final paired sequences were performed (see Section 3.2)

For training in weeks 7 and 8, the labs focussed on the final sequence construction, practice, and performance. The labs followed a format that began with equipment set-up, followed by a warm-up, and the majority of the lab time was dominated by paired sequence work. Similar to the first weeks of training, the principal student investigator handed out the training logs at the beginning of each lab and provided verbal instructions to the participants for practicing the efficacy scale (see Appendix F). Throughout labs 7 and 8, the principal student investigator visited each participant with the cameras and the microphones. The participants were asked to perform their sequences for the principal student investigator using the microphones in

front of the camera, without being recorded. Before each sequence, the participants were reminded of the scale, the performance measure, how to use the scale, and the prompt "scale" should they forget to use the scale. At the end of each sequence, the principal student investigator gave feedback to the participants on their use of the scale. As in previous weeks, at the end of each lab session the participants completed the training log (see Section 3.3.3). The participants then returned the training logs to the principal student investigator who kept the logs in a secured location.

3.3 Measures

3.3.1 Performance measure. The performance measure was based on the sequence evaluation as determined by the course instructor (see Appendix G). The measure focussed on one aspect of the sequence evaluation. This aspect was "body control" which was defined as "the body is controlled at all times: shapes are clear and effective skills". There were four "grade values" based on certain criteria. The "A" criterion (grade range 80-100) was described as "control is excellent. Form and tension allow for high skill level". The "B" criterion (grade range 70-79) was described as "control is very good but is lacking at times in specific focus on body parts". The "C" criterion (grade range 60-69) was described as "control is adequate. Body could attend to greater tension for specific placement of head, feet, arms, and legs". Lastly, the "D" criterion (grade range 50-59) was described as "control is adequate at times and weak at others; requires greater muscular tension for clear shapes". Each skill within the routines was given a numerical grade based on these criteria and accordingly, each participant received multiple grades for their individual routines on a scale of 50-100.

3.3.2 Efficacy measure. Based on Bandura's (2006) recommendations for constructing efficacy scales, there are seven areas that must be attended to when constructing a valid efficacy scale: domain specification, content relevance, item phrasing, response scales, gradations of challenge, social evaluation concerns, and validity. In order to achieve domain specification, Bandura recommended that the efficacy scale should be tailored to level of specificity that the participant will be performing. In this case, the performance measure was linked to efficacy measure. The efficacy scale asked the participants their level of confidence in their ability to achieve a grade of "A" (grade range 80-100) in the body control aspect of the following skill in their individual sequences. The "following skill" was different for all participants, but the scale allowed individual specificity. Therefore, the performance measure was specific to the domain in which the participants were performing (i.e., university class setting with individual routines).

Bandura (2006) further recommends that all items be written in terms of "can do" instead of "will do" when constructing an efficacy scale. This is because items written in terms of "can do" imply a judgement of capability whereas "will do" imply a perception of intent (Feltz, Short et al., 2008). Participants should be assessing only their present capabilities and not assessing future abilities (Bandura, 2006). In order to achieve this recommendation in the present study, the question of the scale read "what is the confidence in your ability that you can achieve the performance standard". In addition, items should be phrased in appropriate sport or task-related terminology (Bandura, 2006). As the scale was only one item that measured efficacy repeatedly, domain specific terminology for the class (grading terminology) was more appropriate for this measure.

The task-related terminology was implied within the "following skill in the sequence" in order to maintain individual specificity.

In order to construct a valid efficacy scale, Bandura (2006) suggested the number of response scales is important in order to achieve accurate measurements of efficacy beliefs. There has been debate of whether the efficacy scale should possess more or fewer response scales. Bandura recommends 11 response categories (i.e., scales of 0-10 or 0-100 in ten unit scales) as he claims it is more sensitive and reliable than fewer response scales. In contrast, Myers and Feltz (2007) contend that fewer categories possess the ability to increase measurement stability and accuracy. As the scale was used in within a "game action" performance, it was plausible that it may be less of a cognitive burden to remember fewer categories (i.e., less response options). Based on recommendations of Myers and Feltz (2007), there were four response options used for the efficacy scale.

In relation to the number of response options, Bandura (2006) also suggests that scales should possess enough gradations of challenge to offer a variation in responses. This is particularly important to avoid ceiling effects so that the majority of scores do not all approach the maximum possible unit of response. Myers and Feltz (2007) suggested respondents have an inability to successfully distinguish between categories when using Bandura (2006)'s original rating scale structure (11 response categories). They suggest that fewer categories would provide an optimal rating structure and produce psychometrically reliable estimates of efficacy beliefs. In order to offer a variation in responses, the present study employed four response categories, providing enough response variation to potentially avoid ceiling effects.

Bandura (2006) also recommends that social evaluative concerns (i.e., evaluation apprehension) should be minimized. He recommends that scale responses should be recorded privately as to reduce influence from outside sources. This was important to the present study as participants rated their confidence during a paired performance. In order to limit the ability for the partners to hear the others' responses, the use of microphones was employed. Each participant wore a microphone that attached to their arm with an armband. The participants were then reminded to respond to the scale quietly without talking directly into the microphone. During the performance, only the student principal researcher was able to hear the participants' responses as microphones were directly attached to the video cameras. Each microphone was attached to an individual camera in order to ensure that each participant's responses were attached only to that participant. Although efforts were made to avoid social biases, the methods used in the study did not entirely prevent all participants from hearing their partner's responses be able to hear each other. Therefore, it was not guaranteed that all social biases were eliminated.

Lastly, Bandura (2006) highlights the recommendation of validity of an efficacy scale. In the case of scale construction, he stresses the importance of face validity. Face validity is the property of a test that it appears it will measure what it claims to measure (Feltz, Short, et al., 2008). Although the focus of the present study was not to establish the validity of a self-efficacy measure, validity is nonetheless a recommendation of scale construction.

Taking Bandura's (2006) recommendations into account, the efficacy scale posed the question: "What is your confidence in your ability that you can receive an 'A' grade (80-100%) for body control on the following skill in your gymnastic sequence?" (see

Appendix H). The response categories ranged from 1-4 with 1 representing "no confidence", 2 representing "low confidence", 3 representing "moderate confidence", and 4 representing "high confidence". The scale was similar in fashion to the Borg (1998) scale which measures people's ratings on perceived exertion, and can be used to monitor responses during physical activity. The Borg scale is a combination of numerical and descriptive association for feelings of fatigue and exertion. The descriptors are meant to help the participant chose the correct number relating the perceived exertion during physical activity. These category-ratio scales have been found to be valid and reliable based on previous research despite the one-item measurement (Borg, 1998). In the present study, the participant completed the scale, rating their confidence immediately before each skill in their sequence, rating only their confidence in their ability to receive an "A" grade on the body control aspect of their performance.

3.3.3 Training log. Upon consent to the study, each participant was given a training log, based on participant number. Although the names of participants appeared on the inside of the training log, the front of the training log was identified only by participant number to maintain confidentiality. In the training log, the following items were provided: the consent form, the demographic information questionnaire (including questions regarding age, sex, and expertise), a copy of the performance measure for reference, a copy of the efficacy measure for reference, the training log sheets (see Appendix I), and a performance sequence plan (see Appendix J).

After each of the nine lab sessions throughout the semester, participants completed a series of questions to ensure the effectiveness of the training (see Appendix I). In the training log, the participants were first asked if they met the principal

investigator (yes or no response). This was not only to ensure that the participants trained to use the scale in front of the principal student investigator but also so that the principal student investigator ensured the participants were training the scale in class. The participants were then asked if using the scale interrupted the performance in front of the principal investigator (yes or no response). This was asked to determine if the participants were distracted or self-conscious from the principal student investigator's presence. Two Likert-type scale questions followed, asking the participants to rate how easy/hard they felt it was to perform their sequence while using the scale and how easy/hard it was to quickly and accurately rate their efficacy while executing the performance. The scale was a seven-point scale with 1 being "very difficult" and 7 representing "very easy". These questions were posed to ensure that training was effective and the participants were finding it easier as the semester progressed to perform sequences while using the scale and rate their efficacy during performance. Finally, the training log asked the participants to estimate how many times they practiced using the scale, including the time with the principal investigator. This was to ensure that participants practiced with the scale at minimum once per week in order to develop an ability to use the scale at the same time as the performance. The participants dated and signed the training log at the end of each lab session and returned the training log to the principal student investigator.

The final item in the training log was the performance sequence plan. This was provided to allow participants to plan their sequences. The performance sequence plan also provided a visual prompt of where to use the efficacy scales within each individual sequence. The performance sequence plan allowed participants to record the category of their skill (e.g., levels, balance) followed by the actual skill, and a visual reminder of

when to use the efficacy scale. The participants were encouraged to remove the performance sequence plan from the training log and keep it for their records. The performance sequence plan provided to the student was four pages long, and the first page of the plan is provided in Appendix J, with the plan repeating itself along the three remaining pages.

3.4 Statistical Analyses

In order to address the previous research objectives, following statistical analyses were used:

Research objective 1. To assess whether performance predicted self-efficacy after controlling for past self-efficacy and if self-efficacy predicted performance after controlling for past performance, a path analysis technique was employed. This technique was applied in the Feltz trial-to-trial diving series (e. g, Feltz 1982, 1988; Feltz & Mugno, 1983; Feltz, Chow, et al., 2008). A path analysis expresses an explicit model of causal relationships (Klem, 1997). The model examined the effects of present self-efficacy on subsequent performance and present performance on subsequent self-efficacy. The model also tested the effects of present performance on subsequent performance and present self-efficacy on subsequent self-efficacy to ensure that performance is not only affecting performance and self-efficacy is not only affecting self-efficacy. Klem (1997) suggests that a comprehensive measure of model fit involves comparing all implied correlations to all actual correlations. Measuring past performance effects on present performance effects is consistent with the Feltz diving series (e.g., Feltz, 1982), although measuring past self-efficacy effects on present self-efficacy is not. At the suggestion of Klem (1997) to have a comprehensive model, measuring past self-

efficacy on present self-efficacy was included. An example of a path diagram of a path analysis is shown in Figure 2.

Path analysis provides both the estimations of the magnitude of the hypothesized effects (self-efficacy on performance, and performance on self-efficacy), and allows testing of the hypothesized model's consistency with the observed data (Klem, 1997). If the model is not consistent with observed data, the model can be rejected or adjusted based on the observed data. In order to calculate path coefficients from the data, multiple regression analyses was used. Klem (1997) suggests that each direct path coefficient is the result of the regression coefficient from the appropriate regression analysis. It is important to note that standard errors, regression coefficient significance, and explained variance by predictor variables (i.e., the R^2) are also relevant to path analysis results (Klem, 1997).

Klem (1997) suggests there are two limitations to testing the model fit using path analysis. Firstly, model fit is not related to the magnitude of coefficients or the amount of variance explained in the variables in the model. Though observed data may fit the model perfectly, the percentage of variance that the model explains may be very small. Secondly, model fit does not confirm if the model is correct. The observed data may fit the model perfectly, but this does not confirm that the model is correct (Klem, 1997). Therefore, though the data may fit the hypothesized model, the variance may not be explained or the model may not be accurate. It is important to consider these limitations with conclusions of model fit in the case of path analysis.

Research objective 2. To investigate whether self-efficacy significantly differed as a function of performance over the course of one uninterrupted physical activity task,

performance scores were divided by means of a tertiary split. High performance groups and low performance groups were compared by a one-way ANOVA in terms of their self-efficacy scores. Self-efficacy scores immediately following performance scores (i.e., Performance 1, Efficacy 2 and Performance 2, Efficacy 3 etc.) were used to examine differences in self-efficacy as a function of high and low performance. All scores for all participants across all routines were used for this analysis.

Chapter Four: Results

4.1 Training Data

To ensure that participants were practicing the scale and to ensure that the use of the scale became automated, the participants were asked to complete a series of questions after each lab session. Participants indicated they met with the principal student investigator each week. There were also no suggestions from the participants that the presence of the principal student investigator interrupted performance. Responses to the Likert-type scale questions indicated that participants found it somewhat easy to perform sequences while using the scale ($M = 5.08$; $SD = 1.43$) with mean responses ranging from 4.9 ($SD = 1.54$) to 5.4 ($SD = 1.31$). Furthermore, participants found it somewhat easy to quickly and accurately rate their efficacy during their sequences ($M = 5.06$; $SD = 1.41$) with mean responses ranging from 4.79 ($SD = 1.47$) to 5.46 ($SD = 1.48$). Lastly, participants indicated that they practiced using the efficacy scale on average 5.83 ($SD = 5.77$) times per lab with mean practice totals ranging from 4.6 ($SD = 3.39$) to 7.34 ($SD = 8.18$). A summary of the training data can be found in Table 1.

4.2 Treatment of the Data

In collecting data from individualized gymnastics sequences, the number of performance and efficacy scores varied for each participant. Performance score totals ranged from 18 to 45 and efficacy score totals ranged from 4 to 41. Therefore, in order to select cases that would most reflect the participants' performance capabilities and efficacy beliefs, five time points within the routine were chosen using select criteria.

Only time points in which the efficacy responses were greater than or equal to the missing efficacy responses were considered for analysis (see Figure 3). In using this

criterion, efficacy responses at time points 1-23 were used in the selection process. Based on Nunnally's (1978) suggestion, of the 23 points, only time points with performance interrater reliability above .50 were included. This was expanded to include time points with performance interrater reliability above .40 to increase the number of time point options. Next, time points with 30 efficacy responses and above, as well as time points which contained the full range of efficacy scores (1-4) were considered. Finally, the relationship in time during the sequence was taken into consideration. Using these criteria, five time points were chosen (times 1, 3, 7, 13, and 17) and were renamed time points 1-5 (i.e., 1 = 1; 2 = 3; 3 = 7; 4 = 13; 5 = 17). These five time points were used to determine the results for research objective 1.

In order to examine research objective 2, all performance and efficacy points were included in the analysis. The resulting totals were 1286 performance scores and 808 efficacy scores. The performance scores were then divided into thirds, resulting in tertiary split of the data. The middle third of the performance scores were removed, and only the top and bottom thirds were kept for analysis. All analyses were conducted using PASW Statistics 18.0.

4.3 Interrater Reliability of the Performance Measure

In order to establish the consistency of scoring between the independent scorers, interrater reliability was calculated using Pearson's correlation coefficient for each of the five time points for the performance measure. Results revealed that the mean interrater reliability score was $r = .52$, $p < .001$ with scores ranging from with a minimum of $r = .42$ to a maximum of $r = .64$. Nunnally (1978) contends that the adequacy of a measurement's reliability depends on the use of the measurement, and therefore

reliabilities between .50 and .80 are usually sufficient for research purposes. He further suggests that in early stages in basic research, measurements require only modest reliability. As the performance measure was used for basic research and was used in an exploratory study, interrater reliability was considered adequate for this study.

4.4 Research Question 1: Assumptions of Multiple Linear Regression Analysis

4.4.1 Normality of sampling distributions: Skewness and kurtosis. At each time point in the sequence, both performance and efficacy scores were assessed for normality by assessing skewness and kurtosis values. Efficacy scores all exhibited slight negative skewness, although no skewness values were significant compared to a value of 1. Performance scores did not exhibit any significant cases of skewness. In terms of kurtosis, efficacy scores at Time 2 were considered having high kurtosis with a score of 6.17. All other efficacy scores did not exhibit significant kurtosis. Performance scores did not exhibit significant kurtosis. Given that there are no known transformation for kurtosis and small skewness values, no data transformations were applied. Descriptive statistics are provided in Table 2.

4.4.2 Outliers. The data for performance scores and efficacy scores at each time point was inspected for multivariate outliers by assessing Malhalanobis' distance and comparing it with χ^2 as calculated by degrees of freedom equal to the number of variables of interest (n = 10) at $p < .001$ (Tabachnick & Fidell, 2007). Using these criteria, any case with a Malhalanobis' distance ≥ 23.21 was considered a multivariate outlier. No such cases were seen in the data and thus all cases were included for further analysis.

4.4.3 Linearity. Linearity refers to the assumption that variables are related though straight line relationships (Tabachnick & Fidell, 2007). To test this assumption, bivariate scatterplots were visually inspected for all possible combination of variables. No evidence of other relationships including curvilinear relationships was seen. Therefore, the assumption of linearity was met.

4.4.4 Multicollinearity. Multicollinearity occurs when variables are highly correlated, and thus may contain redundant and unnecessary information (Tabachnick & Fidell, 2007). In order to investigate multicollinearity, Pearson correlation coefficients were calculated for each time point for both efficacy and performance scores. Results revealed that all variables were below the criteria as suggested by Tabachnick and Fidell (2007) of .90 (see Table 3 for correlations), suggesting that multicollinearity was not a problem for the present analysis.

4.5 Research Objective 1: To Assess the Reciprocal Relationship between Self-Efficacy and Performance within one Continuous Physical Activity Routine

To examine the predictive relationships between performance and self-efficacy, a path analysis of the five time points within the gymnastic sequences was conducted. Consistent with previous studies to examine the predictors of performance (e.g., Feltz, Chow, et al., 2008), current performance was entered as the dependent variable, with past performance entered as a predictor in Block 1 and self-efficacy entered as a predictor in Block 2. The only exception was Performance 1, which had no prior performance information. Therefore, Efficacy 1 was the only predictor variable. In order to examine the predictors of self-efficacy, current self-efficacy was entered as the dependent variable, with past self-efficacy entered as a predictor in Block 1 and past performance entered as a

predictor in Block 2. The only exception was Efficacy 1, where no previous efficacy or performance information was available. Therefore, there were no predictors for Efficacy 1 and thus it was not reported. Results indicated that although there were some cases where past efficacy predicted subsequent efficacy (Efficacy 1 predicting Efficacy 2 and Efficacy 2 predicting Efficacy 3), past performance was not a significant predictor of subsequent efficacy scores. Furthermore, past performance was shown to be a strong and consistent predictor of subsequent performance, although past efficacy was not shown to be a significant predictor of subsequent performance. Summaries of the performance predictors are shown in Table 4 and summaries of the efficacy predictors are shown in Table 5. The path analysis diagram is provided in Figure 4.

4.6 Research Question 2: Assumptions of ANOVA

4.6.1 Normality of sampling distributions: Skewness and kurtosis. Based on a tertiary split of performance scores, scores for the top and bottom groups were assessed for normality by assessing skewness and kurtosis values. All performance and efficacy scores exhibited slight negative skewness, with the exception of the upper performance scores which showed a slight positive skewness. However, no skewness values were significant compared to a value of 1. All performance and efficacy scores showed slight kurtosis, although no values were significantly above 1. Again, given that there are no known transformation for kurtosis, and the relatively small values for skewness, no data transformations were applied. Descriptive statistics are provided in Table 6.

4.6.2 Homogeneity of variance. According to Tabachnick and Fidell (2007), homogeneity of variance refers to the assumption that the variability in each dependent variable is approximately equal. Levene's statistic was used to calculate equality of

variance. Results revealed that Levene's statistic was significant at 13.17, $p < .01$, thus the assumption of equal variances was not met. Results were interpreted with equal variances not assumed.

4.6.3 Equality of sample sizes. Given that each group was divided into equal parts for the analysis using one-way ANOVAs, the assumption of equal sample sizes was confirmed.

4.6.4 Independent observations. The assumption that individual observations are independent suggests that each observation is not influenced by another factor or observation (Tabachnick & Fidell, 2007). This was not the case for the present sample as efficacy scores and performance scores were both provided for the same participant, and thus independent observations could not be assumed. Although this assumption was violated, analysis continued with the knowledge that this had occurred.

4.7 Research Question 2: To investigate whether Self-efficacy significantly Differs as a Function of Performance within a Continuous Physical Activity Routine

To examine whether efficacy beliefs differed as a function of high and low performance over the course of a single routine, a tertiary split of the performance scores was performed. A performance group x efficacy ANOVA was run, with subsequent efficacy scores associated past performance scores entered as the dependent variable, and the high or low performance grouping variable entered as a fixed factor. Results of the analysis revealed that there was a significant difference in self-efficacy between groups with high ($M = 3.6$; $SD = .67$) and low ($M = 3.4$, $SD = .80$) performance scores over the course of a continuous gymnastic routine [$F(1, 531) = 7.16, p < .01, \eta^2 = .01$].

Specifically, instances of higher performance showed higher self-efficacy beliefs and instances of lower performance scores showed lower self-efficacy beliefs.

4.8 Exploratory Analyses: Influences of Sex and Previous Experience

4.8.1 Exploratory analysis 1: To assess the reciprocal relationship between self-efficacy and performance as a function of sex.

Based on previous studies regarding the sex differences the relationship between self-efficacy and performance (e.g. Feltz, 1988; Weinberg et al., 1980), potential differences in the self-efficacy-performance relationship as a function of sex were addressed as part of an exploratory analysis. Based on a demographic information questionnaire found in the training log, participants self-identified as either male or female. Path analyses similar to the path analysis reported in section 4.5 was conducted for both males and females. Current performance was entered as the dependent variable, with past performance entered as a predictor in Block 1 and self-efficacy entered as a predictor in Block 2. Again, the only exception was Performance 1, which had no prior performance information. Therefore, Efficacy 1 was the only predictor variable. In addition, in order to examine the predictors of self-efficacy, current self-efficacy was entered as the dependent variable, with past self-efficacy entered as a predictor in Block 1 and past performance entered as a predictor in Block 2. The only exception was Efficacy 1, where no previous efficacy or performance information was available. Therefore, there were no predictors for Efficacy 1 and thus was not reported.

Results for males revealed that although there were instances of past self-efficacy significantly predicting present self-efficacy (Efficacy 2 predicting Efficacy 3 and Efficacy 3 predicting Efficacy 4), past performance was not a significant predictor of subsequent self-efficacy. There were again instances of past performance significantly

predicting present performance (Performance 2 predicting Performance 1 and Performance 4 predicting Performance 5); however self-efficacy was not a significant predictor of performance. For females, results indicated that there were no significant predictors of self-efficacy. Furthermore, past performance was a consistent significant predictor of subsequent performance. Summaries of the performance predictors for males are shown in Table 7 and for females in Table 8. Summaries of the efficacy predictors for males are shown in Table 9 and for females in Table 10. Path analysis diagrams are provided in Figure 5 for males and Figure 6 for females.

4.8.2 Exploratory analysis 2: To assess the reciprocal relationship between self-efficacy and performance as a function of previous gymnastic experience.

Based on previous information regarding novice and experienced athletes as forwarded by Beilock et al. (2002) and Feltz, Short, et al. (2008) citing Beilock and Feltz (2006), an exploratory analysis of the relationship between self-efficacy and performance as a function of previous gymnastic experience was conducted. Using information provided in the demographic questionnaire, groups were formed by whether the participants' stated that they did or did not have previous gymnastics experience. Path analysis was conducted similar to both sections 4.5 and 4.8.1. Efficacy 4 was deleted as a variable for experienced athletes as all participants reported identical self-efficacy scores, thus the variable was considered a constant, and could not be used within the analysis.

Results for experience athletes revealed that there were again no predictors of present self-efficacy beliefs although Efficacy 1 was able to significantly predict Performance 1. This was the only case in which efficacy significantly predicted performance within the study. Furthermore, past performance was a significant and

consistent predictor of subsequent performance, although efficacy did not predict performance beyond Efficacy 1 and Performance 1. Results for the novice athletes revealed that there were no significant predictors for self-efficacy beliefs. There were two instances in which past performance predicted subsequent performance (Performance 1 predicting Performance 2 and Performance 4 predicting Performance 5) although past self-efficacy was not a significant predictor of present performance. Summaries of the performance predictors for experienced athletes are shown in Table 11 and for novice athletes in Table 12. Summaries of the efficacy predictors for experienced athletes are shown in Table 13 and for novice athletes in Table 14. The path analysis diagrams are provided in Figure 7 for experienced athletes and Figure 8 for novice athletes.

Chapter Five: Discussion

The present study examined the reciprocal relationship between self-efficacy and performance in a continuous educational gymnastics sequence. It was hypothesized that a reciprocal relationship would be demonstrated with past self-efficacy predicting subsequent performance after controlling for past performance and past performance predicting subsequent self-efficacy beliefs after controlling for past self-efficacy beliefs. Findings indicated that this hypothesis was not supported. Results revealed that past performance was a consistently strong predictor of subsequent performance, with only early past self-efficacy predicting early subsequent self-efficacy beliefs (i.e., Efficacy 1 predicting Efficacy 2, and Efficacy 2 predicting Efficacy 3). Later self-efficacy beliefs (i.e., Efficacy 3-5) within the sequence were not predicted by past self-efficacy beliefs or past performance beliefs. These findings suggest that within a continuous educational gymnastics routine, past performance information is more influential on subsequent performance than self-efficacy beliefs.

The current study also investigated whether self-efficacy differed as a function of high and low performance scores within the course of continuous physical activity task. It was hypothesized that self-efficacy would be higher with better performance scores (i.e., high body control scores) and would be lower with lesser performance scores (i.e., low body control scores). This hypothesis was supported as results revealed that there were significant differences between groups with high and low performance scores resulting in higher and lower self-efficacy beliefs respectively. These results suggest that confidence beliefs differed based on performance successes or failures within a continuous educational gymnastics routine.

5.1 The Reciprocal Relationship between Self-Efficacy and Performance

The primary objective of the present study was to examine the reciprocal relationship between self-efficacy and performance within a continuous physical activity routine. Results did not reveal a recursive relationship as performance did not predict self-efficacy nor did self-efficacy predict performance. Past performance was the only significant predictor of present performance. Furthermore, past self-efficacy responses were the only significant predictors of present self-efficacy beliefs. These results suggest that within a continuous educational gymnastics routine, there is no reciprocal relationship between self-efficacy and performance.

These results are both consistent and inconsistent with previous research. The finding that past performance was a strong and consistent predictor of subsequent performance is consistent with previous research. Feltz (1982, 1988), and Feltz and Mugno (1983) found that past performance was a stronger predictor of current performance than self-efficacy. However, these studies all occurred within highly controlled, unchanging environments. The present study occurred in a variable, "real-life", physical activity environment. Previous studies with variable, ecologically valid sport situations found that past performance did not have an effect on present performance (George, 1994). These findings render the present results inconsistent with previous research in variable environments.

Furthermore, results of the present study are inconsistent with previous research suggesting a reciprocal relationship between efficacy and physical activity performance. In previous studies (e.g., Feltz, 1982, 1988; Feltz & Mugno, 1983; George, 1994), past self-efficacy was found to be a significant predictor of current performance and past

performance was found to be a significant predictor of present self-efficacy beliefs. This was also found with collective efficacy studies in which collective efficacy predicted performance and performance predicted collective efficacy (e.g., Myers, Feltz, et al., 2004; Myers, Payment, et al., 2004). However, in the present study, efficacy did not predict performance nor did performance predict efficacy. These results suggest that past performance is more influential on present performance in a continuous routine than the previously established reciprocal relationship between self-efficacy and performance.

There are several potential explanations for the present findings. Feltz (1982) suggested in her original diving study that strong paths which connected past performances to current performances could be referred to as performance barriers. She suggested that these barriers make it difficult for self-efficacy to exert a causal influence on performance. Feltz (1982) further indicated that unless an intervention is conducted to weaken performance barriers, change in performance will not be observed. Performance barriers are a possibility in the present study as past performance accounts for large amounts of variance in current performance (from 20% to 49%) with self-efficacy only accounting for small amounts of variance (1% to 5%) at the same time points. This may suggest that performance barriers are blocking any potential influence of self-efficacy on performance. This was further demonstrated in Performance 1, in which there were no past performance measures, only self-efficacy measures, to predict present performance scores. At this time point, self-efficacy accounted for 46% of variance in the present performance scores. This suggests that using past performance without intervention to predict present performance may reduce the influence of self-efficacy beliefs on present performance in continuous physical activity tasks.

In relation to performance barriers, Bandura (1997) contended that past performance is actually a "conglomerate index" of sociocognitive factors including self-efficacy beliefs. Feltz, Chow et al. (2008) further noted that the predictive strength of past performance on subsequent performance could be inflated unless past self-efficacy beliefs are removed from the variance of past performance. Therefore in order to examine the predictive strength of past performance on present self-efficacy and present performance, Bandura recommended that self-efficacy should be partialled out of past performance, resulting in an adjusted score that had not been influenced by self-efficacy (Heggestad & Kanfer, 2005). In the present study, raw past performance scores were used to predict both present self-efficacy and present performance. Based on the previous suggestions, using raw past performance scores without partialling out subsequent self-efficacy scores, potentially inflated the predictive strength of past performance scores. Again, this could have accounted for the large amount of variance accounted for by past performance in the current performance scores. However, the use of raw past performance scores in the present study does not account for the lack of predictive strength of past performance on present self-efficacy beliefs.

Contextual factors outside of past performance effects may have had an influence of self-efficacy beliefs. George (1994) found that following strong performances in waves 4 and 6 of his study, self-efficacy beliefs of the participants dropped in waves 5, 6, and 7. However, it was during these waves that participants faced tough competition. These findings are similar to MacLean and Sullivan's (2003) study, which found that collective efficacy fluctuated based on the upcoming opponent's winning percentage rather than the previous performance of the team. These findings suggest that factors

outside of previous performance experiences may have an effect on self-efficacy beliefs, such as perceived difficulty of the upcoming opponent. Within the present study, although no contextual factors were assessed, including the perceived level of difficulty of the skills within the routine, these factors may have an effect on the appraisal of self-efficacy beliefs. Rather than solely past performance (or enactive mastery experiences) being the main contributor to self-efficacy beliefs, factors such as the cognitive processing of ability information including perceived difficulty or selective attention, may have had a more influential effect on self-efficacy beliefs. Furthermore, sources outside of enactive mastery experiences including vicarious experiences, verbal persuasion, and physiological and affective states may also significantly contributed to self-efficacy beliefs within a single continuous routine. As George (1994) suggested, future research regarding whether specific sources are more influential on self-efficacy than others in certain sport and physical activity situations should be assessed.

Although no reciprocal self-efficacy-performance relationship was observed, it does not necessarily mean that no reciprocal relationships occurred within the continuous gymnastic routines. Social cognitive theory states that the environment, behaviour, and cognitive, emotional, and biological states are mutually interacting factors that affect behaviour which in turn affects both the environment and personal states (Bandura, 1997; Maddux, 1995, 1999). Within the present study, only behaviour (performance) and one aspect of cognitive attributes (self-efficacy) were studied. As previously mentioned, and as suggested by social cognitive theory, additional factors such as environmental, emotional, and biological aspects may have also contributed to the results of the present study. These factors, as well as additional cognitive aspects (i.e., perceived difficulty,

anxiety, and selective attention) may have been acting in a recursive relationship to affect performance behaviours and self-efficacy beliefs within the study.

Lastly, Bandura (1997) suggested that the elapsed time between the time of the efficacy assessment and the action is an important factor that affects the degree of the efficacy-performance relationship. For example, Myers, Feltz, et al. (2004) suggested that the lack of relationship between collective efficacy and performance was due to a temporal gap (6 days) between the efficacy and performance measures. Bandura (1997) further indicated that the most accurate measurement of the efficacy-performance relationship occurs when both are measured in close temporal proximity. However, Feltz (1988) suggested that when performance trials are temporally close in proximity, previous performance experiences may override the effects of self-efficacy beliefs on present performance. Results of the present study support Feltz's (1988) suggestion in that past performance was a stronger predictor of present performance than past self-efficacy beliefs. Other trial-to-trial studies have also shown stronger past-performance/present-performance relationships than past-self-efficacy/present performance relationships (i.e., Feltz, 1982; Feltz & Mugno, 1983; Watkins et al., 1994). However, this does not account for the lack in relationship between past performance and present self-efficacy.

The design of the present study had efficacy responses in close temporal proximity to performance tasks, and as a result, there may not have been time to cognitively process changes in efficacy information based on changes in performance information before the next efficacy response was prompted. In trial-to-trial studies (i.e., Feltz, 1982; Feltz & Mugno, 1983; Watkins et al., 1994), the past-performance/self-

efficacy relationship was a robust and consistent finding. The results of the present study did not reveal significant past-performance/self-efficacy relationships. This may be because in trial-to-trial designs, participants had enough time to cognitively process changes in efficacy information and report these changes following a performance task. In the present study, the design of a continuous physical activity task may not have allowed participants enough time to process efficacy changes and report them before the next efficacy response and performance task were required. Future studies should address the potential effects of studying self-efficacy and performance simultaneously in close temporal proximity such as cognitive processing time between changes in self-efficacy after changes in performance information.

5.2 Differences in Self-Efficacy based on Performance Information

A second objective of the present study was to examine whether there were differences in self-efficacy within a continuous physical activity routine as a result of differences in immediately prior performance levels. Results revealed that instances of higher performance scores had higher self-efficacy beliefs whereas instances of lower performance scores had lower self-efficacy beliefs, resulting in significant differences in self-efficacy between occurrences of low and high performance scores. Therefore, the results suggested that self-efficacy differed within a continuous educational gymnastic routine as a function of higher or lower performance scores.

These findings are consistent with previous research in that better performances resulted in higher levels of confidence and worse performance resulted in lower efficacy levels (e.g., Feltz & Lirgg, 1998). Previous research examining reciprocal relationships in both self-efficacy and performance as well as collective efficacy and performance have

shown that past performances had a positive influences on present efficacy beliefs (Myers, Payment et al., 2004), and specifically that efficacy beliefs significantly increased after a win and significantly decreased after a loss (Feltz & Lirgg, 1998). Although examples of previous research were done over seasons, the present study extends the understanding of the dynamic nature of efficacy beliefs as a result of performance information with consistent results within continuous physical activity tasks.

Feltz and Lirgg (2001) suggested that athletes with higher self-efficacy not only had increased performances, but also worked harder, showed greater persistence, and were likely to participate in a number of activities. In general, individuals with higher levels of confidence usually employ behaviours that lead to desired outcomes (Bandura, 1997). In contrast, individuals with lower levels of self-efficacy may doubt their abilities, give up more easily, and fail to achieve desired objectives. In the present study, instances of higher levels of performance showed higher levels of self-efficacy which may have resulted from participants in those occurrences setting higher goals and showing greater effort and persistence within their routines. In contrast, instances of lower levels of performance showed lower self-efficacy scores which may have resulted in individuals in those cases setting lesser objectives and showing less effort and perseverance within their routine. Although the factors of goal setting, effort, and persistence were not examined in the present study, according to self-efficacy theory these factors may have affected performance behaviours, thus influencing self-efficacy, and resulting in significant differences in confidence between cases with high or low levels of performance

According to Bandura (1986) and Maddux (1995), behaviours are guided and motivated by the evaluation of actions against personal standards and the selection or

alteration of environments. In social cognitive theory, this is known self-regulation. Self-regulation is a process that involves interacting elements including monitoring behavioural feedback, evaluating behaviours, and reacting to self-evaluation feedback (Maddux, 1999). These elements may have contributed to the present results. In instances of higher levels of performance, participants may have monitored and evaluated behaviours more positively, and reacted to evaluation feedback with greater effort and great persistence. As a result of the positive self-regulatory behaviours from increased performance levels, self-efficacy may have been increased as well. Although no direct past-performance/present-efficacy relationship was found in research question 1, self-regulatory behaviours may have affected self-efficacy beliefs, resulting in higher self-efficacy beliefs in cases of higher performance. In turn, in occurrences with lower levels of performance, participants may have monitored and evaluated behaviour more negatively, and reacted to feedback with less effort and less persistence in the face of difficulties. Therefore, as a result of the negative self-regulation behaviours, participants may have developed lower self-efficacy beliefs. Although self-regulatory behaviours were not examined in the present study, the differences in self-efficacy between high and low performance instances may have resulted from differences in self-regulation of the performance behaviour information.

5.3 Exploratory Analyses

5.3.1 Changes in self-efficacy and performance as a function of sex. As part of an exploratory analysis, path analyses were conducted for both male and female participants to address any potential differences in the self-efficacy-performance relationship as a function of sex. Results revealed that for both males and females, there

were no indications of a reciprocal relationship between self-efficacy and performance. For both male and female participants, past performance was the strongest and most consistent predictor of current performance, although for females, past performance accounted for more variance in present performance than for males. Furthermore for both males and females, past performance was not a significant predictor of self-efficacy. Past self-efficacy was a predictor of present self-efficacy for males, whereas it was not for females. These results indicated that there were similar patterns in the relationship between self-efficacy and performance for both males and females, although females showed a stronger past-performance/present-performance relationship than males and males showed more predictors of self-efficacy than females.

Previous research by Weinberg et al. (1980) contended that the relationship between self-efficacy and performance was stronger for males than females, whereas Feltz (1988) found that the reciprocal relationship between self-efficacy and performance more consistent for females than males. Feltz (1988) also found that in early trials, males did not show a reciprocal self-efficacy-performance relationship. The results of the present study are both consistent and inconsistent with previous research. Consistent with Feltz (1988), males did not show a reciprocal relationship between self-efficacy and performance in the current study. Inconsistent with Feltz (1988), females did not show a stronger self-efficacy-performance relationship, although they did show a stronger past-performance/present-performance relationship. Inconsistent with Weinberg et al. (1980), the self-efficacy-performance relationship was not stronger for males than females, and in fact, was not significant for either sex.

Previous studies have suggested that the gender appropriateness of a task influences self-efficacy (Lirgg, 1991). For example, if an activity is considered more masculine, females will have less self-efficacy in the task (Lirgg, George, Chase, & Ferguson, 1996). Clifton and Gill (1994) found that for most cheerleading tasks (a traditionally feminine activity) females were more confident than males. Yet, in two aspects of cheerleading, partner stunts and tumbling, there were no significant differences in confidence levels between sexes. The researchers suggested that partner stunts and tumbling have a more masculine connotation, which would account for the lack of gender differences in confidence. The comparable patterns in the self-efficacy-performance relationship between males and females in the present study could be explained in terms of gender orientation of the activity. Educational gymnastics may be a feminine activity with tasks that have masculine connotations. For example, aspects of educational gymnastics including the use of large apparatuses (risk-taking behaviours) and the emphasis on movement and skill development (physical activity tasks) may be perceived as masculine. If the orientation of the task was strictly feminine, females have been shown to have higher self-efficacy in the task than males (Lirgg, 1991). However, as there were similar self-efficacy-performance relationship patterns for male and female participants, this could provide support for a masculine orientation aspect of educational gymnastics. As found in Clifton and Gill's (1994) study, as there may have been both feminine and masculine aspects to the educational gymnastic routines, male and female participants may have shared similar efficacy-performance relationship patterns. In the present study, perceptions of the gender orientation of educational gymnastics were not

assessed and thus could only be assumed. Future studies may wish to address gender orientations of a task and the efficacy-performance relationship.

The similar efficacy-performance relationships may also be explained by Feltz (1988) who offered two explanations for the non-significant reciprocal relationship between self-efficacy and performance: the range of the self-efficacy scale used in relation to performance and the types of experiences and sources of self-efficacy beliefs. As previously mentioned, it is possible that sources besides past performance affected present self-efficacy within a continuous routine (see Section 5.1). The current findings suggested males used past self-efficacy beliefs as a source for present self-efficacy beliefs more so than females. Neither past performances nor past self-efficacy beliefs were significant sources of present self-efficacy for females suggesting additional sources were more significant in influencing self-efficacy. Although with much variance unaccounted for in male self-efficacy beliefs, significant sources of information for present self-efficacy are also possible. As previously suggested, future research should address added potential sources of self-efficacy beliefs within a continuous physical activity task.

The response range of the self-efficacy scale used in relation to performance may have also accounted for the lack of self-efficacy-performance relationships. Feltz (1988) found that males overrated their efficacy beliefs in relation to their performance if their performance was at the low end of the performance scale. In the present study, neither males nor females showed a reciprocal relationship between self-efficacy and performance. As educational gymnastics involves students working within their own abilities, males as well as females may have overrated or underrated their self-efficacy depending on how they perceived their ability. In a study by Vealey (1988), she found

that males and females did not differ in self-confidence at the elite level of sport. She suggested that this was because females strongly believe that they have the ability to succeed at the task. Therefore, if the male and female participants in the present study both strongly believed in their abilities, both may have overrated their efficacy beliefs in comparison to their performances. As males and females had similar efficacy-performance relationships, as suggested by Feltz (1988), additional sources of self-efficacy or errors in estimation of self-efficacy in relation to performance may have been the cause of these findings.

5.3.2 Changes in self-efficacy and performance as a function of experience.

The second part of the exploratory analyses examined the relationship between self-efficacy and performance as function of previous gymnastics experience. Path analyses were conducted for both participants with previous gymnastics experience (experienced athletes) and no previous gymnastics experience (novice athletes). Results revealed that past performance was the strongest and most consistent predictor of present performance for both novice and experienced participants. For experienced participants, past self-efficacy was a significant predictor of present performance at time point 1, although after this time point, efficacy was no longer found to be a significant predictor of performance. For both experienced and novice participants, no significant predictors of present self-efficacy were found.

In terms of previous research, George (1994) indicated that most research on self-efficacy and performance has been done with novice athletes, and that little research has been conducted regarding expertise and the self-efficacy-performance relationship. He suggested that experience in a task potentially mediates the impact of successful or poor

performances on self-efficacy. Therefore, experienced athletes may have the knowledge that performances will fluctuate to some extent and may not affect self-efficacy beliefs to a great extent. The results of the experienced athletes in the present study may be explained by George's (1994) suggestion. Experienced participants may have had their performances fluctuate without significant variations in their self-efficacy, resulting in the lack of a predictive relationship between self-efficacy and performance. Instead of self-efficacy being a predictor because of the knowledge that performance fluctuations are possible, past performance then becomes the significant predictor of present performance for experienced athletes. This would be consistent with previous research by Feltz (1982) who suggested that as participants gained experience in a task, self-efficacy became less of a predictor of present performance than past performance.

However, George (1994) suggested that novices may experience a greater impact of performance fluctuations which would lead to a greater modification of self-efficacy beliefs. A study by Kitsantas and Zimmerman (2002) found that after basketball misses, experienced athletes' self-efficacy remained unchanged whereas novice athletes' self-efficacy dropped from initial levels. In the present study, the results for the novice athletes were comparable to the experienced athletes, suggesting that in an educational gymnastics routine, experienced and novice performances are relatively similar. This could be explained by the task itself. Educational gymnastics requires students to work within their own abilities to achieve skills rather than an externally imposed level of achievement (Nilges, 1997). Therefore, although novice athletes had no previous gymnastic experiences, their experience with their own abilities could render them "experts" in their own body movements. The externally imposed title of "novice" or

"experienced" may not apply in the case of educational gymnastics, which would result in similar findings in terms of the relationship between self-efficacy and performance for athletes of both previous experience levels. Future studies should address the methodical limitations of educational gymnastics in terms of expertise and perhaps study a sport or physical activity task in which novice and experienced athletes could be more clearly defined.

In terms of attentional differences between novice and experienced athletes, previous research found that experienced athletes perform better with an external focus of attention (i.e., environment) whereas novice athletes perform better with an internal focus of attention (i.e., skill) (Beilock et al., 2002). Beilock and Feltz (2006) further suggested that the process of forming efficacy beliefs may "use up" attentional capacity that novices could use for the successful execution of skills (Feltz, Short et al., 2008). Asking self-efficacy levels of both experienced and novice athletes during performance may detract from the performance. This is may be because concentration on both self-efficacy levels and performance may detract from the performance without the knowledge that it is occurring. For experts, focusing on self-efficacy may invoke an internal focus (i.e., self-focus) which would detract from performance. For novices, focusing on self-efficacy may invoke an external focus (i.e., concentrating on an outside source of information) which would support the suggestions of Beilock et al. (2002) and Beilock and Feltz (2006) as stated by Feltz, Short et al. (2008). Further studies should address how focus of attention and self-efficacy are related, and certainly with clearly differentiated expert and novice athletes.

Caution must be used when interpreting the results of the exploratory analyses. The comparison between male and female participants had sample sizes of 27 and 20 participants, resulting in a maximum of 135 and 100 cases respectively. The comparison between novice and experienced participants had sample sizes of 27 and 15 participants, resulting in a maximum of 135 and 75 cases correspondingly. According to Klem (1997), to conduct a proper path analysis, models must contain 200 to 300 cases at minimum. Therefore, the sample sizes in the exploratory analyses were smaller than would be required for a path analysis. Thus the results of the present study may not be an accurate reflection of the efficacy-performance relationships among male, female, novice, and experienced participants.

5.4 Limitations

One of the major limitations to the present study was the design protocol using an educational gymnastics routine. Firstly, all routines were individualized; each participant had a different number of efficacy scores and performance scores. Therefore, response times for each participant were unique, which made comparison between response times difficult. Furthermore, each participant's routine varied in difficulty which also made comparison between sequences complex. Although ecological validity for the individualized routines was high, a standardized routine would allow for response numbers, response times, and level of difficulty to be relatively equal for all participants.

Secondly, because efficacy responses were given before each skill, there were only seconds between each efficacy response before the next performance task and efficacy response were prompted. Therefore, there may not have been enough time to cognitively process ability information before the next tasks were required. The temporal

proximity between the efficacy and performance measures might be important to achieve a reciprocal relationship between self-efficacy and performance. In the present study, the time between responses may not have been long enough cognitively process efficacy information as a result of performance. To address this limitation, future studies should address studying self-efficacy and performance simultaneously to examine the temporal proximity required for the cognitive processing of ability information to occur between performance and self-efficacy.

An additional limitation has to do with all efficacy scales, in that they are self-report measures. When using self-report measures, there is a risk that participants will not answer accurately or truthfully, and therefore will not be a correct measurement of what that person was feeling. Bandura (1978) contended that in situations where individuals have no reason to distort their responses, self-report measures can be representative of cognitions. However, in the present study, responses were recorded during performance in which both the partner and the researcher could potentially hear the participant's responses. Feltz and Chase (1998) noted that participants find it difficult to report that they had little confidence, especially when others could hear his/her responses.

In relation to the limitation of self-report measures, there is also the limitation of social bias. Bandura (2006) recommended that when self-efficacy measures are used, steps should be taken to eliminate all social bias. Unfortunately, the protocol of the sequences used in class was that routines should be performed in pairs. Therefore, it was possible that the presence of the partner induced bias including social desirability. Perhaps participants responded differently (higher or lower) in fears that their partners

would hear them. Although efforts were made to allow participants to respond quietly into the microphones, it did not guarantee that partners could not hear each other. Furthermore, participants knew that the principal student investigator could hear their responses. Again, in the desire to be socially accepted by their peers, participants may have biased their responses. Participants indicated that the principal student investigator's presence did not affect performance; however no questions were asked about whether the principal student investigator's presence affected efficacy responses. Future studies could address the issue of social bias by eliminating partner work and manipulation checks could be conducted to ensure that the participants' efficacy responses are not affected by the investigator's presence.

Finally, as the efficacy responses were being measured during performance, there was a possibility that the efficacy response aspect and the performance aspect were competing for attentional focus. Although participants trained to use the scale for 8 weeks before the final performance in the ninth week of class, it is a possibility that efficacy responses were affected by performance in terms of attention and vice versa. This further speaks to the differences between novice and experienced athletes in terms of attention and perhaps one group found it easier to use the efficacy measure at the same time as performing his/her sequences. Furthermore, focusing on self-efficacy may have artificially caused internal or external focus of attention – although no studies have examined this issue to date. However there is a possibility that this study limited the cognitive abilities of the participants to divide attention and allow for enough attentional capacity to perform their skills to their best and accurately respond to the efficacy scale.

5.5 Implications

The primary implication of the current study is that it is possible to study the self-efficacy-performance relationship within a continuous physical activity sequence. Feltz, Short, et al. (2008) suggested that studying self-efficacy and performance simultaneously would provide useful information on how self-efficacy is affected in "game-action". The present study provided evidence for their suggestion. The results of the present study imply that in a variable physical activity environment, over the course of an extended performance, that self-efficacy can be studied simultaneously with performance. Unfortunately, this relationship may not be able to be studied all conditions. For example, stating a self-efficacy response within the performance of a golf swing may not be possible due to the time in which the behaviour takes place (i.e., a few seconds). Although there was no significant reciprocal relationship found, there is need to continue to study efficacy within a sport of physical activity routine due to the limitations of the present study.

A second implication of the present study is that within a continuous physical activity routine, the relationship between self-efficacy and performance may not be as significant as previous research has suggested (e.g., Feltz, Chow, et al., 2008). However, the present results also revealed that higher levels of performance resulted in higher levels of self-efficacy. If the present results are indeed an accurate reflection of what occurs in an uninterrupted physical activity performance, instances of higher performance levels generally show increased self-efficacy, although the influence of self-efficacy on performance and performance on self-efficacy may not be instantly significant. Specifically, self-efficacy may not significantly fluctuate immediately following changes

in performance and performance may not significantly vary immediately following changes in self-efficacy, and self-efficacy may remain relatively constant as a result of performance. This implies that in order to have increased levels of performance, athletes should make efforts to maintain high levels of performance as past performance is a strong predictor of present performance. Should these levels of performance remain relatively high, according to these results, self-efficacy should also remain high. As self-efficacy may be an important source of information prior to and following performance, maintaining high levels of self-efficacy may be important to athletic performance, although not within a continuous performance. Until further research is done in the area of continuous performances, maintaining consistent high levels of performance and high levels of self-efficacy should continue to be an important training aspect for athletes.

5.6 Future Directions

The future directions of the study will address the protocol in studying self-efficacy and performance during a continuous sport or physical activity sequence. The present study was limited in using educational gymnastics because of the variation in individual sequences. The strengths of using educational gymnastics were that the ecological validity was high and that the performance was long enough to study levels of self-efficacy at various points within the routine. Future studies could address the methodology used to examine the relationship between self-efficacy and performance by choosing a standardized routine. This routine must vary in terms of difficulty for all participants, be long enough to have several standardized efficacy measurement points (without too much or too little time passing between performance and efficacy measurements), and not be sufficiently hard to detract from attention to self-efficacy. As with the present study, there must also be sufficient time to allow training time of the

scale (although 8 weeks may not be ideal in future studies). Instead, more intense training, in shorter time periods should also be employed. In taking into account all of these suggestions future studies will test various protocols in order to find an ideal methodology to study the self-efficacy-performance relationship.

Future studies could also address the effects of using a self-efficacy measurement during performance. Because cognitive functioning must be divided while doing two tasks at the same time, there is a possibility that either or both tasks could be affected. This is evident in terms of attention, as previous studies suggested that internal or external focus can affect performance (i.e., Beilock et al., 2002). As self-efficacy is a judgement on one's own ability, it has yet to be determined if focusing on self-efficacy affects attention during performance. For example, if concentrating on self-efficacy artificially draws attention to an internal focus of attention, what effect this has on performance should be studied. Furthermore, focusing on self-efficacy during a performance may not affect performance at all as attention could remain external for experienced athletes or internal for novice athletes. Future studies should not only address protocol in the methodology of studying the self-efficacy-performance relationship in a continuous sequence, but also the effects of cognitive functioning on participants while studying this relationship.

Along with examining the cognitive effects of studying performance and efficacy simultaneously within a continuous sport or physical activity performance, future directions should also address potential sources of influence on efficacy beliefs that may be more significant than the influence of past performance. The results of present study suggested that due to lack of variance accounted for by past performance in self-efficacy

scores, that performance was not a significant predictor of self-efficacy. As previously suggested factors such as the cognitive processing of ability information including perceived difficulty and selective attention may have more of an effect on self-efficacy beliefs rather than simply successful or unsuccessful performance experiences. Additional sources of self-efficacy including vicarious experiences, verbal persuasion, and physiological and affective states may also have a significant effect on self-efficacy within an uninterrupted performance. Future studies should examine these sources of self-efficacy, along with performance within a continuous sport or physical activity routine.

5.8 Conclusions

The present study found that within a continuous educational gymnastics routine, the relationship between self-efficacy and performance was not reciprocal. In general, the most consistent and significant predictor of present performance was past performance, and the most consistent and significant predictor of present self-efficacy was past self-efficacy. There were similar patterns in the efficacy-performance relationship in terms of sex and level of previous experience among the participants. There were however significant differences in the levels of self-efficacy between cases with high performance scores and low performance scores. The present study suggests that it is possible to concurrently study efficacy and performance within an uninterrupted physical activity situation. Furthermore, these results indicate that maintaining consistent high levels of performance within a continuous physical activity routine may result in successful physical activity performances and higher self-efficacy beliefs. Not only is the physical training aspect of a physical activity or sport task important to maintain high

levels of performance, but also the psychological training aspect to maintain high efficacy beliefs. Based on the present results, it appears that efficacy-performance relationship within a continuous physical activity routine may not be as significant as previously suggested. Future studies should continue to examine the efficacy-performance relationship within continuous physical activity and sport situations in order to further develop an understanding of cognitive functioning within physical activity performances.

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Table 1

Means and Standard Deviations of Training Log Data

	Skill Question		Efficacy Question		Practice Question	
Week	*M*	*SD*	*M*	*SD*	*M*	*SD*
Week 1	5.07	1.42	5.16	1.49	4.63	4.95
Week 2	5.4	1.31	5.37	1.35	7.05	6.29
Week 3	4.93	1.43	4.95	1.32	5.59	3.91
Week 4	4.97	1.36	5.00	1.39	4.60	3.39
Week 5	5.07	1.42	4.91	1.36	4.63	3.76
Week 6	4.95	1.45	4.79	1.47	6.15	7.45
Week 7	5.04	1.33	4.99	1.41	5.44	5.35
Week 8	4.90	1.55	4.88	1.44	7.34	8.18
Week 9	5.39	1.55	5.46	1.48	7.05	8.64
Totals	5.08	1.42	5.06	1.41	5.83	5.77

Note: Skill Question = How easy/difficult was it to perform the skills in your sequence while using the scale; Efficacy Question = How easy/difficult was it to quickly and to accurately rate your efficacy while performing your sequence; Practice Question = How many times did you practice using the scale (including your session with the Principle Student Investigator. Values for the Skill and Efficacy Questions were on 1 (very difficult) to 7 (very easy) Likert-type scales.

Table 2

Mean, Standard Deviation, Skewness, and Kurtosis Values for Performance and Efficacy Scores

Variable	*M*	*SD*	Skewness	Kurtosis
Efficacy 1	3.55	.76	-1.74	2.61
Efficacy 2	3.66	.67	-2.34	6.17
Efficacy 3	3.48	.81	-1.55	1.79
Efficacy 4	3.57	.82	-1.85	2.63
Efficacy 5	3.53	.72	-1.79	3.82
Performance 1	74.13	6.02	-.19	-.73
Performance 2	73.63	7.1	-.81	.52
Performance 3	72.93	7.83	.28	.59
Performance 4	72.89	7.98	.06	.41
Performance 5	73.02	7.59	-.15	-.71

Note: Efficacy scores ranged from 1 to 4; Performance scores ranged from 52.5 to 93.5

Table 3

Bivariate Correlations for Performance and Efficacy Scores

	Eff1	Eff2	Eff3	Eff4	Eff5	Eff6	Perf1	Perf2	Perf3	Perf4	Perf5
Eff 1	-	.38*	.21	.04	-.13	-.10	.22	.46**	.27	.21	.34*
Eff 2		-	.67**	.26	.36	.09	.03	.13	.28	.32*	.30
Eff 3			-	-.33	.23	.12	.10	-.02	.13	.32	.18
Eff 4				-	.36	.62**	.01	-.16	.24	.25	.44*
Eff 5					-	.16	.00	.13	.12	.21	.16
Eff 6						-	.07	-.00	.19	.22	.16
Perf1							-	.54**	.50**	.52**	.39**
Perf2								-	.33*	.44**	.40**
Perf3									-	.53**	.40**
Perf4										-	.64**
Perf5											-

Note: Correlations are reported using Pearson's correlation coefficients

Eff = Efficacy; Perf = Performance

*p < .05; **p < .01

Table 4

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Performance Times 1 - 5

Variable	Step	β	*t*	R^2	ΔR^2
Performance 1	Efficacy 1	.21	1.32	.46	.46
Performance 2	Performance 1	.44**	2.97	.20	.20
	Efficacy 2	.12	.80	.21	.01
Performance 3	Performance 2	.51**	3.23	.26	.26
	Efficacy 3	.13	.87	.28	.01
Performance 4	Performance 3	.58**	3.82	.35	.35
	Efficacy 4	.14	.93	.37	.02
Performance 5	Performance 4	.67**	5.2	.49	.49
	Efficacy 5	-.22	-1.74	.50	.05

**$p < .01$

Table 5

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Self-Efficacy Times 1 - 5

Variable	Step	β	*t*	R^2	ΔR^2
Efficacy 2	Efficacy 1	.39*	2.26	.14	.14
	Performance 1	-.06	-.36	.14	.00
Efficacy 3	Efficacy 2	.68**	4.45	.44	.44
	Performance 2	-.12	-.80	.46	.01
Efficacy 4	Efficacy 3	.22	.96	.05	.05
	Performance 3	.21	.37	.10	.04
Efficacy 5	Efficacy 4	-.09	-.37	.02	.02
	Performance 4	-.16	-.16	.04	.02

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

Table 6

Mean, Standard Deviation, Skewness, and Kurtosis Values for Performance and Efficacy Scores for the Top and Bottom Thirds of Performance Scores

Variable	*M*	*SD*	Skewness	Kurtosis
Low Performance	65.78	3.67	-1.26	2.7
Low Efficacy	3.43	.80	-1.34	1.1
High Performance	80.32	3.69	1.15	1.3
Low Efficacy	3.6	.67	-1.67	2.41

Note: Performance scores ranged from 52.5 to 93.5; Efficacy scores ranged from 1 to 4.

Table 7

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Performance Times 1 - 5 for Males

Variable	Step	β	*t*	R^2	ΔR^2
Performance 1	Efficacy 1	.05	.24	.00	.00
Performance 2	Performance 1	.44*	2.19	.18	.18
	Efficacy 2	.20	.99	.22	.04
Performance 3	Performance 2	.00	.02	.00	.00
	Efficacy 3	.13	.46	.01	.01
Performance 4	Performance 3	.40	1.77	.17	.17
	Efficacy 4	.32	1.41	.28	.10
Performance 5	Performance 4	.60**	2.96	.33	.33
	Efficacy 5	-.29	-1.47	.42	.08

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

Table 8

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Performance Times 1 - 5 for Females

Variable	Step	β	*t*	R^2	ΔR^2
Performance 1	Efficacy 1	.45	1.96	.20	.20
Performance 2	Performance 1	.51	2.14	.26	.26
	Efficacy 1	-.00	-.02	.26	.00
Performance 3	Performance 2	.84**	6.06	.71	.71
	Efficacy 2	.12	.87	.72	.01
Performance 4	Performance 3	.76**	.34	.52	.52
	Efficacy 3	-.16	-.78	.54	.02
Performance 5	Performance 4	.77**	4.28	.66	.66
	Efficacy 4	-.18	-.10	.69	.03

**$p < .01$

Table 9

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Self-Efficacy Times 1 - 5 for Males

Variable	Step	β	*t*	R^2	ΔR^2
Efficacy 2	Efficacy 1	.45	1.96	.19	.19
	Performance 1	-.01	-.35	.10	.00
Efficacy 3	Efficacy 2	.84**	4.76	.70	.70
	Performance 2	-.13	-.77	.71	.01
Efficacy 4	Efficacy 3	.66*	2.48	.42	.42
	Performance 3	.38	1.42	.56	.14
Efficacy 5	Efficacy 4	-.43	-1.08	1.7	1.77
	Performance 4	.01	.04	1.7	.00

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

Table 10

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Self-Efficacy Times 1 - 5 for Females

Variable	Step	β	*t*	R^2	ΔR^2
Efficacy 2	Efficacy 1	.02	.07	.00	.00
	Performance 1	.07	.22	.00	.00
Efficacy 3	Efficacy 2	.38	1.36	.14	.14
	Performance 2	-.05	-.18	.14	.00
Efficacy 4	Efficacy 3	-.16	-.48	.02	.02
	Performance 3	.19	.57	.05	.03
Efficacy 5	Efficacy 4	.65	2.18	.43	.43
	Performance 4	-.13	-.45	.45	.01

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

Table 11

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Performance Times 1 - 5 for Experienced Athletes

Variable	Step	β	*t*	R^2	ΔR^2
Performance 1	Efficacy 1	.69*	3.04	.48	.48
Performance 2	Performance 1	.33	1.12	.10	.10
	Efficacy 2	-.16	-.56	.12	.02
Performance 3	Performance 2	.86**	6.22	.72	.72
	Efficacy 3	.34	2.45	.84	.11
Performance 4	Performance 3	.69*	2.54	.48	.48
Performance 5	Performance 4	.67*	2.71	.54	.54
	Efficacy 5	-.23	-.93	.59	.04

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

Table 12

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Performance Times 1 - 5 for Novice Athletes

Variable	Step	β	*t*	R^2	ΔR^2
Performance 1	Efficacy 1	.14	.66	.02	.02
Performance 2	Performance 1	.63**	3.74	.43	.43
	Efficacy 2	.16	.98	.46	.02
Performance 3	Performance 2	.41	1.71	.16	.16
	Efficacy 3	-.17	-.75	.20	.03
Performance 4	Performance 3	.38	1.86	.2	.24
	Efficacy 4	.41	1.99	.40	.15
Performance 5	Performance 4	.71**	4.24	.46	.46
	Efficacy 5	-.28	-1.71	.55	.08

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

Table 13

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Self-Efficacy Times 1 - 5 for Experienced Athletes

Variable	Step	β	*t*	R^2	ΔR^2
Efficacy 2	Efficacy 1	.04	.11	.04	.04
	Performance 1	.28	.65	.10	.05
Efficacy 3	Efficacy 2	.49	1.51	.20	.20
	Performance 2	-.24	-.76	.26	.06
Efficacy 5	Performance 4	-.27	-.82	.07	.07

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

Table 14

Summaries of Hierarchical Regressions Analysis for Variables Predicting Current Self-Efficacy Times 1 - 5 for Novice Athletes

Variable	Step	β	*t*	R^2	ΔR^2
Efficacy 2	Efficacy 1	.13	.55	.02	.02
	Performance 1	.09	.39	.03	.00
Efficacy 3	Efficacy 2	.04	.15	.00	.00
	Performance 2	.02	.31	.01	.00
Efficacy 4	Efficacy 3	.56	.09	.00	.00
	Performance 3	.05	1.97	.30	.29
Efficacy 5	Efficacy 4	-.48	-1.33	.13	.13
	Performance 4	.18	.52	.16	.02

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

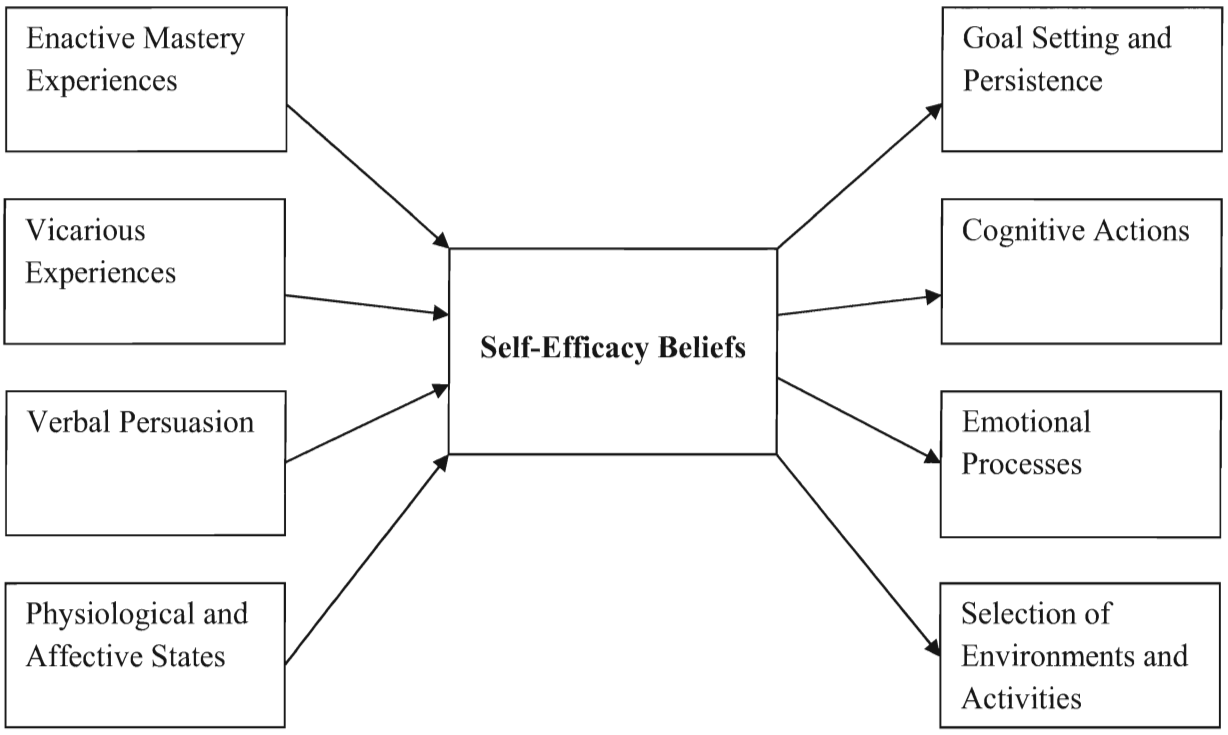


Figure 1. Sources and outcomes of self-efficacy beliefs as adapted from Feltz and Chase (1998, p. 66).

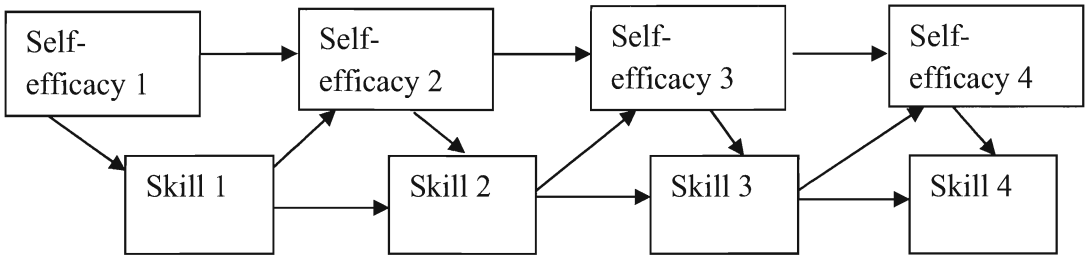


Figure 2. Example of path diagram for the self-efficacy/sport performance model based on Feltz (1982).

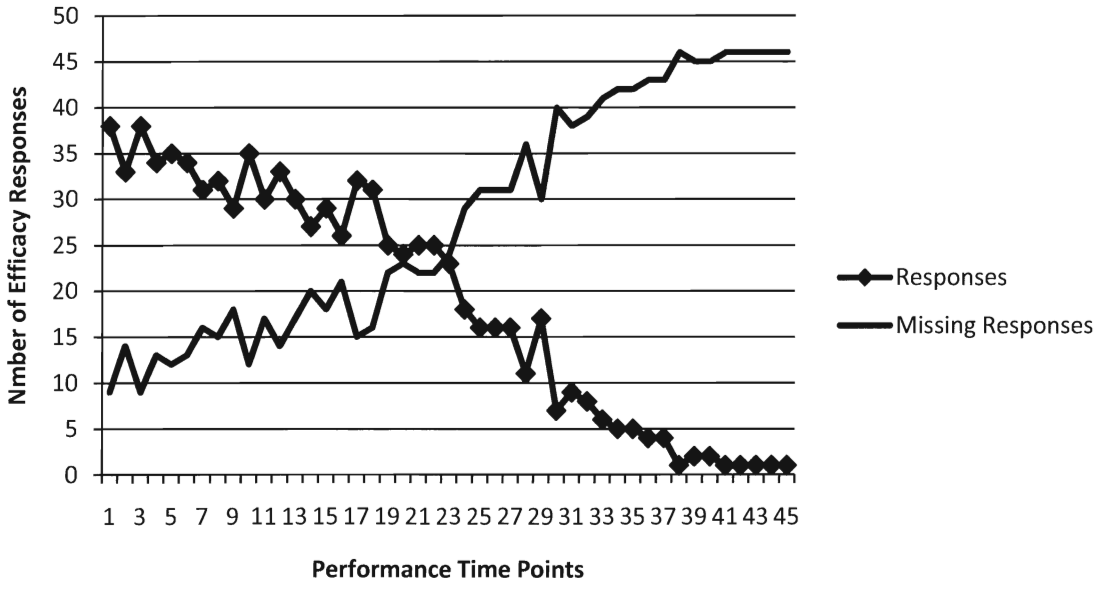


Figure 3. The interaction between the number of efficacy responses and number of missing efficacy responses as a function of the performance time points.

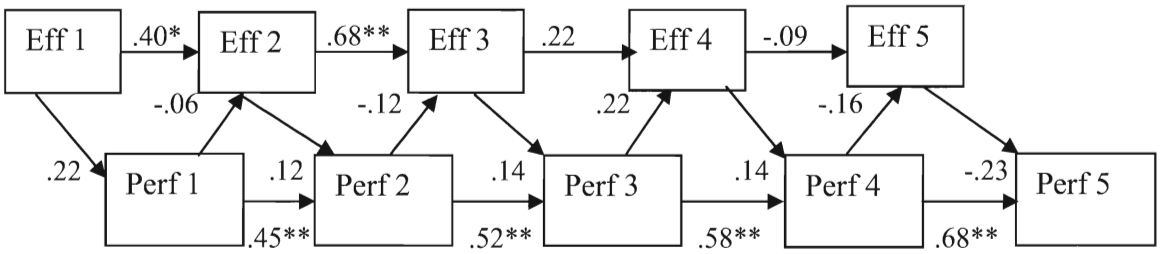


Figure 4. Path diagram for the overall relationship between self-efficacy (Eff) and performance (Perf); Paths are reported in terms of their βs

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

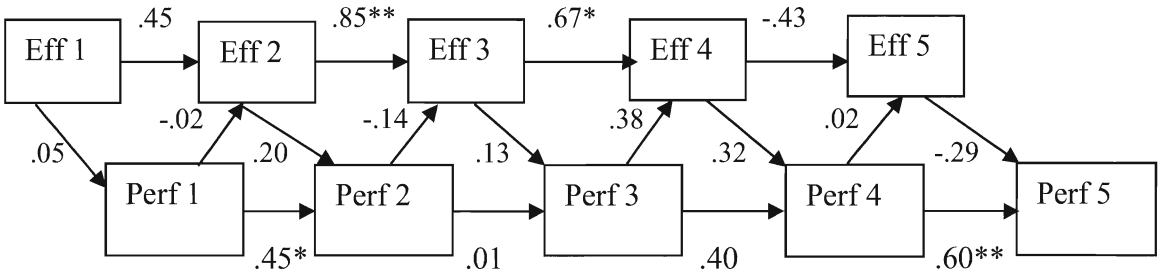


Figure 5. Path diagram for the males' relationship between self-efficacy (Eff) and performance (Perf); Paths are reported in terms of their βs

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

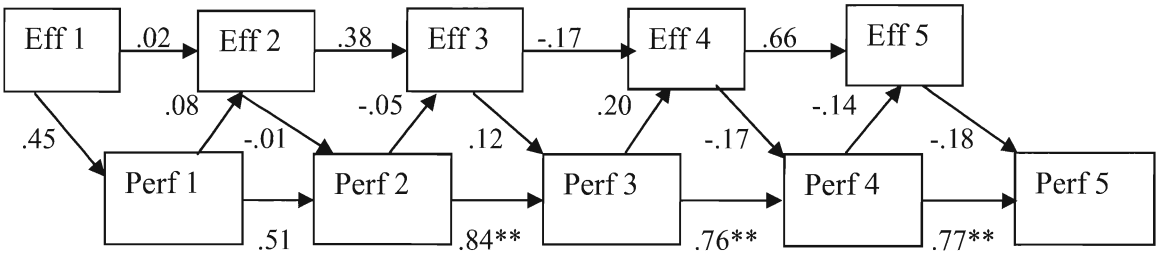


Figure 6. Path diagram for the females' relationship between self-efficacy (Eff) and performance (Perf); Paths are reported in terms of their βs

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

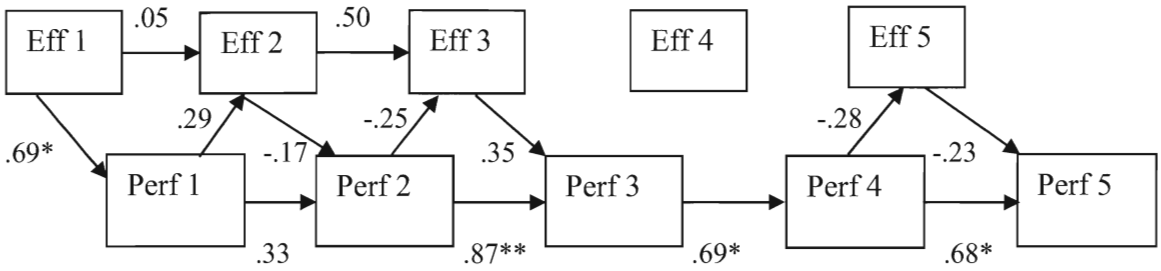


Figure 7. Path diagram for the experienced athletes' relationship between self-efficacy (Eff) and performance (Perf); Paths are reported in terms of their βs,

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

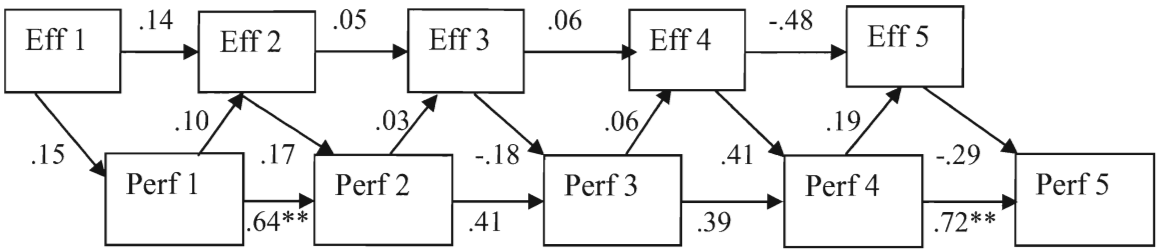


Figure 8. Path diagram for the novice athletes' relationship between self-efficacy (Eff) and performance (Perf); Paths are reported in terms of their βs

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

Appendix A

Copy of Research Ethics Board Approval Email

DATE: 1/14/2010

FROM: Michelle McGinn, Chair
Research Ethics Board (REB)

TO: Dr. Philip Sullivan, Physical Education and Kinesiology
Kaitlyn LaForge

FILE: 09-117 SULLIVAN
Masters Thesis/Project

TITLE: An Analysis of the Relationship between Self-Efficacy and Performance in a Continuous Gymnastic Routine

---

The Brock University Research Ethics Board has reviewed the above research proposal.

DECISION: Accepted with note

Note: Please be sure to describe the confidence measure in your verbal recruitment script

This project has received ethics clearance for the period of **January 14, 2010 to August 1, 2010** subject to full REB ratification at the Research Ethics Board's next scheduled meeting. The clearance period may be extended upon request. ***The study may now proceed.***

Please note that the Research Ethics Board (REB) requires that you adhere to the protocol as last reviewed and cleared by the REB. During the course of research no deviations from, or changes to, the protocol, recruitment, or consent form may be initiated without prior written clearance from the REB. The Board must provide clearance for any modifications before they can be implemented. If you wish to modify your research project, please refer to http://www.brocku.ca/research/policies-and-forms/forms to complete the appropriate form Revision or Modification to an Ongoing Application.

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

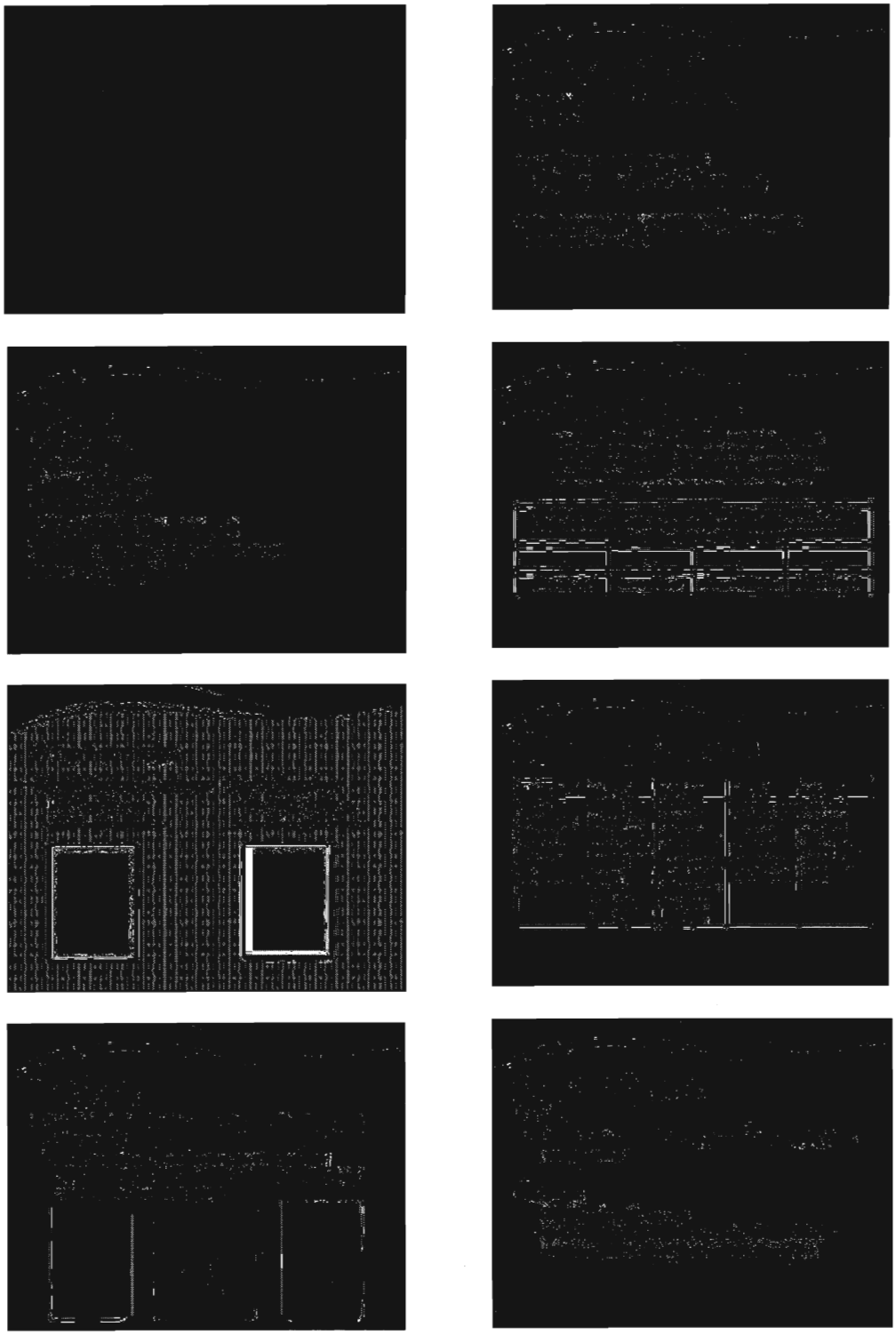
The Tri-Council Policy Statement requires that ongoing research be monitored. A Final Report is required for all projects upon completion of the project. Researchers with projects lasting more than one year are required to submit a Continuing Review Report annually. The Office of Research Services will contact you when this form *Continuing Review/Final Report* is required.

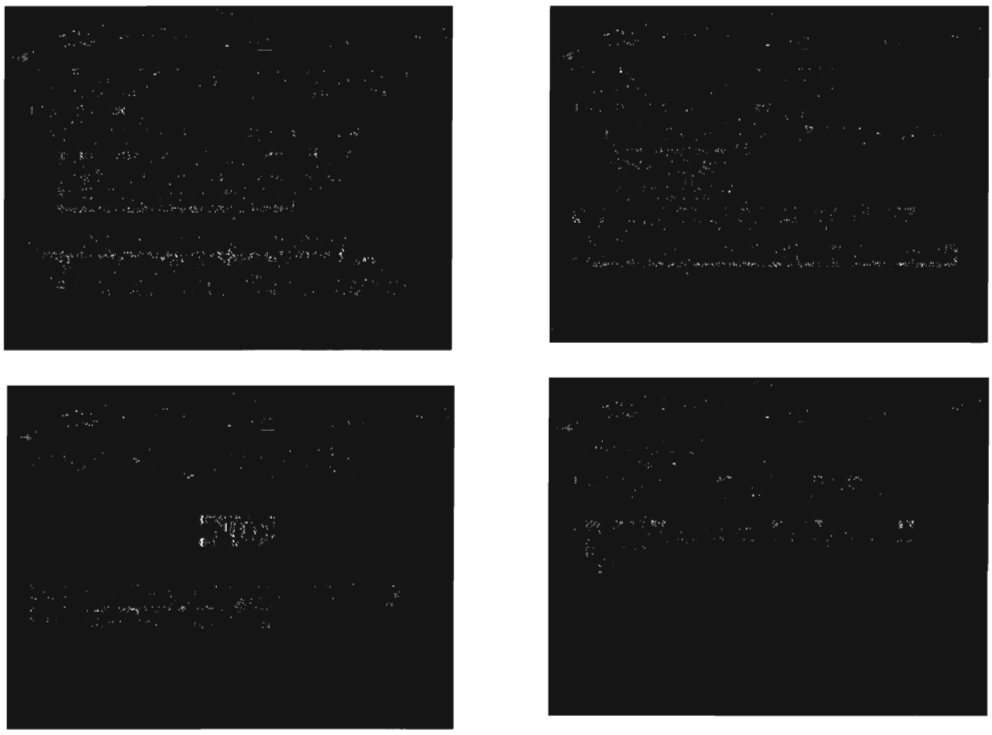
Please quote your REB file number on all future correspondence.

MM/sp

Appendix B

Recruitment Presentation





Appendix C

Consent Form

Date: January 2010
Project Title: **An Analysis of the Relationship between Self-Efficacy and Performance in a Continuous Gymnastic Routine**

Principal Student Investigator: **Kaitlyn LaForge, MA Candidate**
Department of Physical Education and Kinesiology, Brock University
Email: **kl08iw@brocku.ca**
Phone: **(905) 688-5550 Ext. 4787**

Faculty Supervisor: **Dr. Philip Sullivan**
Department of Physical Education and Kinesiology, Brock University
Email: **psullivan@brocku.ca**
Phone: **(905) 688-5550 Ext. 4787**

INVITATION
You are invited to participate in a research study that will examine how confidence changes in sport performance.
WHAT'S INVOLVED?
At the end of the semester, you will be asked to perform your final sequence while using a confidence measure. In order to use this measure, training will be required throughout the semester. Participation will take place in the lab component of your class and will require no more time than your lab attendance (2 hours / week). Practice with the measure will take place during the individual practice component of your lab. You will meet with the principle student investigator during this practice session to discuss concerns, answer questions, and discuss progression with the measure. At the end of each lab, you will fill out a brief training log which will be kept in the faculty supervisor's office. Your grades will not be affected by your participation in this study.
POTENTIAL BENEFITS AND RISKS
Possible benefits of participation include the chance to aid in the advancement of sport performance research. No foreseeable risks are associated with participation than would be experienced in class.
CONFIDENTIALITY
All information you provide is considered confidential; your name will not be included or, in any other way, associated with the data collected in the study. Furthermore, because our interest is in the average responses of the entire group of participants, you will not be identified individually in any way in written reports of this research. Data collected during this study will be stored in a locked office. Data will be kept for one year following the completion of the study after which time any files will be destroyed. Access to this data will be restricted to the Principal Investigator and the Faculty Supervisor.
VOLUNTARY PARTCIPATION
Participation in this study is voluntary. If you wish, you may decline to participate in any component of the study. Furthermore, you may decide to withdraw from this study at any time and may do so without any penalty.
PUBLICATION OF RESULTS
Results of this study may be published in professional journals and presented at conferences. Feedback about this study will be available through the Principle Investigator. Information on how to receive your results will be provided at the end of the study.
CONTACT INFORMATION AND ETHICS CLEARANCE
If you have any questions about this study or require further information, please contact the Principal Investigator or the Faculty Supervisor using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University (*insert file #).* If you have any comments or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, **reb@brocku.ca.** Thank you for your assistance in this project. Please keep a copy of this form for your records.
CONSENT FORM
I agree to participate in this study described above. I have made this decision based on the information I have heard though the description of the Principal Investigator. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Appendix D

Demographic Questionnaire

1) Age: _____

2) Sex (check one): Male _____ Female_____

3) Do you have any previous experience in gymnastics? Yes_____ No_____

If **yes,** please provide the following information (if no, please skip to question # 4)

a) Length of time involved: _____

b) Were you involved in competitions? Yes_____ No_____

c) Highest level of competition? _____

d) Type of gymnastics (e. g., rhythmic, artistic, etc): _____

4) Please list any other sports that you have been involved in, the highest level of competition, and the length of time you were involved:

Sport	Highest level of competition	Length of time

5) Do you have any concerns about participating in this study?

Appendix E

Debriefing Email

Dear [redacted]

I want to express my extreme gratitude for all of your help with my research project this semester. Your patience and efforts are very much appreciated. I couldn't have completed the data collection portion of the project without each and every one of you.

As the project is complete, I will take this opportunity to let you know the purpose of the study. Research has shown that there is a relationship between self-efficacy and sport performance (e.g., Moritz et al., 2000). Specifically this relationship has been shown to be reciprocal, meaning that self-efficacy affects performance and in turn, performance affects self-efficacy (e.g., Feltz, 1983). On the recommendation of Feltz et al (2008), we wanted to study this relationship in a continuous sport performance, as "game-action" self-efficacy/performance relationships have not yet been studied. Therefore, the purpose of the study was not only to see if a self-efficacy measure could be used during a sport performance, but also to investigate whether a reciprocal performance-efficacy relationship was present in a continuous routine.

If you have any further questions about the study, please do not hesitate to contact me. My email address is kl08iw@brocku.ca. Any inquiries are encouraged and welcomed!

Again, I cannot thank you enough for all of your help with this project. Your enthusiasm and willingness to help was greatly appreciated. I look forward to seeing you all around Brock! Don't hesitate to say hello!!

Sincerely,

Kaitlyn LaForge
MA in Applied Health Sciences candidate
Brock University
St. Catharines, ON, Canada

Appendix F

Week Number	Dates	Theme	Class Outline	Efficacy Scale Instructions
Week 1	January 25, 28	Body Awareness: Balance	Warm-up; Formal instructions; Apparatus work	"What is 'good' body control?"; Rate confidence in body control before each balance on apparatuses
Week 2	February 8, 11	Spatial Awareness: Directions and Pathways	Warm-up; Formal instructions; Individual sequence work	Rate confidence in body control before change of skill or movement during formal instruction and sequence work
Week 3	February 18, March 1	Individual Sequence Evaluations	Warm-up; Creation of individual sequences; performance and marking of sequences	Understand body control marking scheme using performance marking sheet; Use scale during individual sequence performance
Week 4	March 4, 8	Body Awareness: Twisting and Turning; Relationship: Copying, Matching, Mirroring	Warm up; Formal instruction; Partner sequences on large apparatuses	Practice to use the scale during formal instruction and during partner sequences; If time, perform sequence while using scale in front of principal student investigator
Week 5	March 11, 15	Space Awareness: Levels; Relationships Negotiations	Warm up; Formal instruction; Partner work on large apparatuses	Create sequence without scale; Practice sequence with scale; Perform sequence with scale out loud in front of principal student investigator

Week 6	March 18, 22	Relationships: Negotiations	Warm up; Formal instructions with partners; Partner sequences on large apparatuses	Create sequence without scale; Practice sequence with scale; Perform sequences with scale and microphones in front of principal student investigator
Week 7	March 25, 29	Final Performance Practice	Final Sequence Preparation	Create sequence without scale; Practice sequence with scale; Perform sequences (what was done to that point) with scale using microphones and cameras in front of principal student investigator
Week 8	April 1, 5	Final Performance Practice	Final Sequence Practice	Practice sequence with scale; Perform sequences with scale using microphones and cameras in front of principal student investigator
Week 9	April 8, 12	Final Performances	Final Sequence Performance	Create order of performance; Practice sequence with scale; Final performances with scale using microphones and cameras with principal student investigator; Rest; Final performances with course instructor

Appendix G

Performance Measure

Body Control	D (50-59)	C (60-69)	B (79-79)	A (80-100)
Body is controlled at all times; shapes are clear and effective for skills	Control is adequate at times and weak at others. Requires greater muscular tension for clear shapes.	Control is adequate. Body could attend to greater tension for specific placement of head, feet, arms, legs.	Control is very good but is lacking at times in specific focus on body parts.	Control is excellent. Form and tension allow for a high skill level.

Appendix H

Efficacy Measure

Rate your confidence for the upcoming skill/skill set/movement phrase in your routine based on the scale. Make sure to answer the scale immediately before each skill in your sequence. Answer as quickly and as accurately as possible while speaking quietly into the microphone.

What is your confidence in your ability that you can receive an "A" grade (80-100%) for body control on the following skill/skill set/movement phrase in your gymnastic sequence?			
1	2	3	4
No confidence	Low confidence	Moderate confidence	High confidence

Appendix I

Training Log Example

1) Did you meet with the Principle Student Investigator?

   (Circle one) YES NO

2) Did using the scale interrupt your performance in any way in front of the Principle Student Investigator?

   (Circle one) YES NO

3) How easy/difficult was it to perform the skills in your sequence while using the scale?

   (Circle one)

1	2	3	4	5	6	7
Very Difficult	Moderately Difficult	Somewhat Difficult	Not Difficult nor Easy	Somewhat Easy	Moderately Easy	Very Easy

4) How easy/difficult was it to quickly and to accurately rate your efficacy while performing your sequence? (Circle one)

1	2	3	4	5	6	7
Very Difficult	Moderately Difficult	Somewhat Difficult	Not Difficult nor Easy	Somewhat Easy	Moderately Easy	Very Easy

5) How many times did you practice using the scale (including your session with the Principle Student Investigator)? _____

Signature: Date:

_____ _____

Appendix J

Performance Sequence Plan Example

Sequence Performance and Efficacy Planning Aid

Things that will help:

1) Practice, practice, practice
2) Be honest!
3) Whisper! – the microphones are sensitive though that they will pick up your voice
4) Say the scale before each skill/skill set/movement phrase. Use the planning aid below to show you where and when you need to the scale based on your sequence
5) Have fun and do your best!

Example:

Partner Theme: Mirroring Secondary Theme: Balance

Efficacy Scale		Efficacy Score: 3 (said out loud)
Theme (s): Mirroring/Balance	Description: Hold "left leg-up" balance on trap box for count of 3 (asymmetrical)	Performance Score: *Scored later by individual scorer.*

Repeat until the end of the sequence.

Partner Theme:_____ Secondary Theme:_____

Efficacy Scale		Efficacy Score:
Theme(s):	Description:	Performance Score:
Efficacy Scale		Efficacy Score:
Theme(s):	Description:	Performance Score:
Efficacy Scale		Efficacy Score:
Theme(s):	Description:	Performance Score:
Efficacy Scale		Efficacy Score:
Theme(s):	Description:	Performance Score: